UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Northwest Region
7600 Sand Point Way N.E., Bldg. 1
Seattle, WA 98115

September 6, 2000

Sonny J. O'Neal
Forest Supervisor
United States Department of Agriculture
Forest Service
215 Melody Lane
Wenatchee, Washington 98801

Re: Biological Opinion for the Skyline Irrigation Ditch (WSB-98-061)

Dear Mr. O'Neal:

This document transmits the National Marine Fisheries Service's (NMFS) biological opinion (BO) for the reinstatement of a special use permit to the Skyline Ditch Company for the continuing operation of their surface water diversion from the Chewuch River, a tributary to the Methow River, Okanogan County, Washington. This BO analyzes the effects of the proposed action to the endangered Upper Columbia River steelhead (*Oncorhynchus mykiss*) and the endangered Upper Columbia River spring chinook salmon (*O. tshawytscha*), and their designated critical habitats, in accordance with section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 15311 *et seq*.) Formal consultation was initiated on June 24, 1999.

This BO is based on information provided in a biological assessment (BA) dated March 10, 1998, and subsequent amendments to the BA that fulfilled the informational needs to complete formal consultation. A complete administrative record of this consultation is on file at the Washington State Habitat Branch Office.

The Forest Service has determined that the proposed project is likely to adversely affect the above listed species, but would not jeopardize the continued existence of the species or result in the destruction or adverse modification of their critical habitats.

The enclosed document represents NMFS' biological opinion on the above listed species in accordance with section 7 of the Endangered Species Act of 1973, as amended, (16 U.S.C. 1531 *et seq.*). Please note that it is our biological opinion that the action, as proposed, is likely to jeopardize the continued existence of steelhead and spring chinook salmon and result in the destruction or adverse modification of designated critical habitat for both steelhead and spring chinook salmon.

In your review of the BO, please reference the reasonable and prudent alternative (RPA) that can be implemented to avoid the likelihood of jeopardizing the continued existence of listed species and avert the destruction or adverse modification of designated critical habitat. That RPA identifies conditions that the Forest Service may place on the special use permit for the operation of the Skyline Ditch that allow the Forest Service to issue the special use permit while avoiding jeopardy to listed species and the destruction or adverse modification of critical habitat. The Forest Service is required to notify NMFS of its decision as to whether it will implement the RPA.

In addition, the biological opinion contains an incidental take statement including reasonable and prudent measures to avoid and minimize take and terms and conditions to implement those measures. Also, please note that we have included conservation recommendations.

Should you have any questions, please contact Dennis Carlson at (360) 753-5828.

Sincerely,

for Joe Scordino

William W. Stelle, Jr.
Regional Administrator

Enclosure

ENDANGERED SPECIES ACT - SECTION 7

BIOLOGICAL OPINION,

FOR THE SKYLINE IRRIGATION DITCH
Okanogan National Forest
WSB-98-061

Agency: USDA Forest Service
Okanogan National Forest

Consultation
Conducted By: National Marine Fisheries Service
Northwest Region
Washington State Habitat Branch

Approved ____________________________________ Date ____________
William W. Stelle, Jr.
Regional Administrator

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I. CONSULTATION HISTORY

The U.S. Department of Agriculture, Okanogan National Forest, Methow Valley Ranger District, has requested Endangered Species Act (ESA) section 7 consultation with the National Marine Fisheries Service (NMFS), Washington State Habitat Branch, for the proposed reinstatement of a special use permit to the Skyline Ditch Company to convey water in the their irrigation ditch across U.S. Forest Service (USFS) managed land in the Okanogan National Forest near Winthrop, Okanogan County, Washington. A chronology of project events follows:

- On March 4, 1998, a Level 1 Team meeting comprised of representatives from the USFS, U.S. Fish and Wildlife Service (USFWS) and NMFS was convened to discuss the proposal;

- On April 28, 1998, the USFS submitted a written request, along with a biological assessment (BA) dated March 10, 1998, to initiate formal section 7 consultation with NMFS;

- On March 18, 1999, the USFS submitted additional information from the Skyline Ditch Company to NMFS regarding proposed structural improvements to the ditch and its operation; and,

- On June 24, 1999, the USFS submitted an amendment to revise portions of the original BA.

The June 24 submittal completed the information necessary for NMFS to conduct the consultation and the date of initiation for formal consultation is June 24, 1999. After that date, the Skyline Ditch Company had committed to draft an operating plan for the year 2000. NMFS had, at the request of the Skyline Ditch Company, suspended processing of the biological opinion (BO) awaiting receipt of a draft 2000 operational plan, which has not yet been submitted. On June 19, 2000 NMFS received an amended BA from the USFS to update new the headgate construction and fish screen installation by the Skyline Ditch Company.

The objective of this BO is to determine whether the proposed action is likely to jeopardize the endangered Upper Columbia River steelhead trout (*Oncorhynchus mykiss*) or the endangered Upper Columbia River spring chinook salmon (*O. tshawytscha*), or result in the destruction or adverse modification of designated critical habitats. The NMFS has reviewed the following information to reach its determination and prepare this BO:

- The available BAs, amendments, maps, USFS's "1999 Operation and Maintenance Plan", and Washington state Department of Fish and Wildlife's (WDFW) "1998 Pre-Irrigation Season Fish Screen Maintenance; Fish Bypass Operation Procedure", and associated attachments.

- Telephone conversations and meetings conducted by Dennis Carlson and Mike Grady of NMFS with Jennifer Molesworth, Mel Bennett and Bill Baer of the USFS, Brad Caldwell of

Washington Department of Ecology (WDOE), Hal Beecher of WDFW, and Jodi Bush of the USFWS.

- Reference materials that include the "Methow River Basin Fish Habitat Analysis Using the Instream Flow Incremental Methodology", Federal Register Notices, the "1992 Washington State Salmon and Steelhead Stock Inventory, Appendix Three, Columbia River Stocks", "Production and habitat of salmonids in Mid-Columbia River tributary streams by Mullan et al.," "NMFS Status Review of West Coast Steelhead from Washington, Idaho, Oregon, and California", "An Ecosystem Approach to Salmonid Conservation", and the "NMFS Status Review of Chinook Salmon from Washington, Idaho, Oregon, and California".

- Comments received on the Draft BO (July 7, 1999) from USFS; the law firm of McQuaid, Metzler, Bedford, and Van Zant; and Peter Morrison of the Pacific Biodiversity Institute.

II. DESCRIPTION OF THE PROPOSED ACTION

The USFS has management authority over national forest lands and grants permits for water conveyance across managed lands to people with valid water rights. The proposed action is to reinstate a special use permit by the USFS to allow the conveyance of water across national forest lands for irrigation and domestic use purposes. The permit request is for a period of ten years, starting from the date of the previous special use permit that expired in 1996.

The USFS had renewed a special use permit to the Skyline Ditch Company on July 14, 1997. That permit did not contain conditions for structural facility maintenance or operational requirements for ditch use to protect anadromous fish. According to the USFS' BA (1998), that permit was subsequently suspended by the USFS when Upper Columbia River steelhead were listed as endangered on August 11, 1997. The suspended special use permit, with any USFS conditions contained in the Operation and Maintenance Plan (an attachment to the special use permit), would be reinstated upon receipt of this BO.

A detailed description of proposed structural improvements to the existing headgate and fish screen and operation of the Skyline Ditch is provided in the USFS BA (1998) and supplemental BA (2000), with mitigation and monitoring measures outlined in the Skyline Ditch Company's letter to the USFS for ditch operation in 1999. A summary of that proposed work follows.

The Skyline Ditch occupies a strip of USFS managed lands that is approximately 2,190 ft. long and 15 ft. wide. The ditch is approximately 6 miles long, and is unlined (USFS 2000). Approximately one mile of the ditch (off USFS managed lands) has been converted to an enclosed pipe. Water conveyance loss is estimated to be approximately 70 percent over the length of the ditch due largely to infiltration (USFS 1998). Current water uses include alfalfa and hay crops, residential lawn and garden use, stock watering, public golf course, orchards, and riparian vegetation watering (USFS 1998). The BA (USFS 1998) references the potential for using ditch water to generate electricity on private lands at some undetermined future time. However, there is no present plan for that action, and it will not be evaluated in this biological opinion.

The Skyline Ditch headgate is located in a man-made side channel along the right side (west bank) of the Chewuch River on National Forest land at about river mile (RM) 7.5, just below the confluence with Boulder Creek. The headgate is blasted into bedrock at the head of the side channel, and does not impede fish passage in the Chewuch. Water enters the side channel through a rock tunnel. The existing headgate is virtually inoperable and water levels in the ditch had been controlled by overflow channels and tail water bypassed back to the river (USFS 1998). Proposed headgate replacement work would entail lifting out the existing structure using a crane boom or an excavator. Access to the work site would be from an existing access road. Approximately 10 cubic yards of cement would be poured to construct a new headgate. A trash rack would also be installed in front of the headgate to prevent debris from damaging the structure. Prior to replacing the headgate, a temporary coffer dam consisting of gravel bags and ecology logs would be placed in the side channel immediately upstream of the work site. The gravel bags and ecology logs would divert water away from the construction site and facilitate headgate construction in the dry. Repair work is expected to be completed in August 2000 (USFS 2000).

A new fish screen would be installed approximately 300 feet down the irrigation ditch from the present screen location. The existing fish screen will be removed but the concrete support structure will remain in the ditch. The new screen would be sited on USFS managed lands just off of County Road 1213. Because the county road provides easy site access, no new road construction would occur. Screen installation would require the removal of up to12 trees from a 50 by 60 ft.- area managed under the Northwest Forest Plan as Riparian Reserve. The screen site is located approximately 2,000 ft. from the Chewuch River. The new screen is designed to accommodate a flow of 17 cubic feet per second (cfs) (USFS 2000). As such, NMFS' analysis assumes a maximum diversion of 17 cfs would occur.

Skyline Ditch is usually operated from mid-April to mid-October each year (USFS 1998). Past measured flows have ranged between 15 and 26 cfs before the bypass (USFS 1998). A fish screen was installed by Washington State Department of Fisheries in 1927 and has been maintained by the State under an annual maintenance agreement since that time. The present screen is sized for 10 cfs flow using current NMFS screening criteria of less than or equal to 0.4 feet per second (fps) approach velocities. The existing ditch headgate is in disrepair and flow into the ditch cannot be controlled at the headgate. Thus, approach velocities at the existing fish screen presently exceed 1 fps (USFS 1998). A Cipolleti weir (a trapezoidal-shaped control section) or other similar flow measuring device is being retrofitted to the present screen to measure actual flow diversion in 2000. Flow measurements would be taken on a regular basis and recorded as a proposed condition contained in the USFS' Operations and Maintenance Plan.

The Skyline Ditch water claim dates back to September 3, 1902. Water claimed is 150 cfs or 4,498 acre feet per year. Ditch Company records indicate approximately 366 acres are allocated or currently paid for ditch shares. One share equals 4 acre feet per acre, so this current use would cover 14 cfs for the 183 day period of a typical diversion period. Measurements conducted at the headgate by different agencies, including the USFS, have shown water diversion varies from 15-26 cfs. The Skyline Ditch Company has filed the underlying water right claim and owns the means of conveyance but has not recorded or monitored on-field application by individual share holders over the years.

There is a side channel located between the Skyline Ditch and the Chewuch River. The side channel is active during high flows and when water is being bypassed from the ditch. The side channel will continue to be used to bypass flows from the ditch. Fish that stray into the ditch would be diverted to the side channel and then exit the channel back to the river. The side channel is located about 50 ft. from the project work site (USFS 2000).

The Skyline Ditch Company Directors also propose to install a pressurized enclosed pipe conveyance system beginning in 2000. Installation of the pipeline system would eliminate conveyance loss and diversion flows could be further reduced below the design flow maximum for the fish screen. At an interagency meeting conducted on April 27, 1999, Jerry Sullivan, Director of the Skyline Ditch Company, claimed that enclosing the ditch within a pipe would reduce the amount of water required for irrigation to 8 cfs. A conversion to the proposed enclosed pipeline system would be implemented in phases if funding is not available to complete the project in 2000. The Skyline Ditch Company's stated goal is to eliminate the direct loss of fish at the screen by implementing the above referenced measures before operating during the 2000 irrigation season.

Action Area

The term "action area" means "all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action." 50 C.F.R. § 402.02. The action area for this consultation is the Chewuch River, starting at the Skyline Ditch Company diversion at RM 7.5, proceeding downstream to the confluence with the Methow River and extending some distance down the Methow River from its confluence with the Chewuch. The precise downstream limit of the action area cannot be easily determined because the extent of indirect effects of the proposed action on Methow River flows varies according to the flow stage. Note that the Chewuch River has been gauged at RM 0.2 since November 1991 (USGS 1994).

III. STATUS OF LISTED SPECIES AND BIOLOGICAL REQUIREMENTS

A. Upper Columbia River Steelhead

Upper Columbia River steelhead were listed as endangered species under the ESA on August 18, 1997 (62 Fed. Reg. 43937). Critical habitat for the upper Columbia River steelhead was designated on February 16, 2000 (65 Fed. Reg. 7764; February 16, 2000). The listing status, biological information, and other information for the Upper Columbia River steelhead is further described in Attachment 1.

Range-wide factors for the decline of west coast steelhead stocks are primarily attributed to the destruction and modification of habitat, overutilization for recreational purposes, and natural and human-made factors (NMFS 1996a, 1996b, 1997). Forestry, agriculture, mining, and urbanization have degraded, simplified, and fragmented habitat. Water diversions for agriculture, flood control, domestic, and hydropower purposes (including the Columbia River Basin) have greatly reduced or eliminated historically accessible habitat. Studies estimate that during the last 200 years, the lower 48 states have lost approximately 53 percent of all wetlands and the majority of the rest are severely degraded (Gregory & Bisson 1997). Washington and Oregon's wetlands are estimated to have diminished by one-third, while California has experienced a 91 percent loss of its wetland habitat (NRC 1996).

Loss of habitat complexity has also contributed to the range-wide decline of steelhead. In portions of some national forests in Washington, there has been a 58 percent reduction in large deep pools due to sedimentation and loss of pool-forming structures such as boulders and large wood (McIntosh et al. 1994). Sedimentation from land use activities is recognized as a primary cause of habitat degradation in the range of west coast steelhead (62 Fed. Reg. 43942).

Steelhead support an important recreational fishery throughout their range. During periods of decreased habitat availability (e.g., drought conditions or summer low flow when fish are concentrated), the impacts of recreational fishing on native anadromous stocks can be heightened (62 Fed. Reg. 43942). Steelhead are not generally targeted in high seas commercial fisheries; however, listed steelhead from the Upper Columbia and Snake River ESUs migrate at the same time and are subject to the same fisheries as unlisted, hatchery-produced steelhead, chinook and coho salmon in the Columbia River.

Steelhead of this listed ESU that are likely to be adversely affected by the proposed action are present in the Chewuch River, a tributary to the Methow River. The Upper Columbia River Basin steelhead ESU occupies the Columbia River Basin upstream from the confluence with the Yakima River, Washington, to the United States - Canada border. The geographic area occupied by this ESU forms part of the larger Columbia Basin Ecoregion (Omernik 1987). The Chewuch River is in the Okanogan Highlands Physiographic Province. The river valleys in this region are deeply dissected and maintain low gradients except in extreme headwaters. The climate in this area includes extremes in temperatures and precipitation, with most precipitation falling in the mountains as snow. Streamflow in this area is provided by melting snowpack, groundwater, and runoff from alpine glaciers.

The proposed action would occur within designated critical habitat for Upper Columbia River steelhead. Defining specific river reaches that are critical for steelhead is difficult because of the low abundance of the species and of our imperfect understanding of the species' freshwater distribution, both current and historical (65 Fed. Reg. 7764; February 16, 2000). Based on consideration of the best available information regarding the species' current distribution, NMFS believes that the preferred approach to identifying critical habitat for steelhead is to designate all areas accessible to the species within the range of specified river basins in this ESU (65 Fed. Reg. 7764; February 16, 2000).

Essential features of steelhead critical habitat include adequate substrate, water quality, water quantity, water temperature, water velocity, cover/shelter, food, riparian vegetation, space, and safe passage conditions. Good summaries of the environmental parameters and freshwater factors that have contributed to the decline of steelhead can be found in reviews by Barnhart (1986); Pauley *et al.*, (1986); California Advisory Committee on Salmon and Steelhead Trout (CACSST) (1988); Brown and Moyle (1991); Bjornn and Reiser (1991); Higgins *et al.*, (1992); Nehlsen *et al.*, (1991); California State Lands Commission (1993): Reynolds *et al.*, (1993); Botkin *et al.*, (1995); McEwan and Jackson (1996); NMFS (1996); NMFS (1996a, 1996b, 1997); and Spence *et al.*, (1996).

Estimates of historical (pre-1960s) steelhead abundance specific to this ESU are available from fish counts at dams. Counts at Rock Island Dam from 1933 to 1959 averaged 2,600 to 3,700, suggesting a pre-fishery run size in excess of 5,000 adults for tributaries above Rock Island Dam (Chapman *et al.*, 1994). Recent five-year (1989-1993) average natural escapements for the Methow and Okanogan Rivers was 450 steelhead. Recent average total escapements for this stock was 2,400. Average total run size at Priest Rapids Dam for the same period was approximately 9,600 adult steelhead (62 Fed. Reg. 43949; August 18, 1997). Hatchery programs and harvest management have strongly influenced steelhead populations in the Upper Columbia River Basin ESU. Hatchery programs intended to compensate for habitat losses have masked declines in natural stocks and have created unrealistic expectations for fisheries (62 Fed. Reg. 43944; August 18, 1997). Collection of natural steelhead for broodstock and transfers of stocks within and between ESUs has detrimentally impacted some populations (62 Fed. Reg. 43944; August 18, 1997).

Trends in total (natural and hatchery) adult escapement for the Methow and Okanogan Rivers combined show a 12 percent annual decline from 1982-1993 (NMFS 1996a, 1996b; August 18, 1997). This stock, plus the Wenatchee River stock, represent most of the escapement to natural spawning habitat within the range of the ESU (62 Fed. Reg. 43949; August 18, 1997).

Steelhead in the Upper Columbia River ESU continue to exhibit low abundances, both in absolute numbers and in relation to numbers of hatchery fish throughout the region. Review of the most recent data indicates that natural steelhead abundance has declined or remained low and relatively constant in the major river basins in this ESU (Wenatchee, Methow, Okanogan) since the early 1990s (NMFS 1996a, 1996b, 1997). Estimates of natural production of steelhead in the ESU are well below replacement (approximately 0.3:1 adult replacement ratios estimated in the Wenatchee and Entiat Rivers) (62 Fed. Reg. 43949; August 18, 1997). These data indicate that natural steelhead populations in the Upper Columbia River Basin are not self-sustaining at the present time. There is also anecdotal evidence that resident rainbow trout contribute to anadromous run abundance. This phenomenon would reduce estimates of the natural steelhead replacement ratio (62 Fed. Reg. 43949; August 18, 1997).

The proportion of hatchery fish is high in these rivers (65-80 percent). Substantial genetic mixing of populations within this ESU has occurred, both historically as a result of the Grand Coulee Fish Maintenance Project (GCFMP) and more recently as a result of the Wells Hatchery program. Extensive mixing of hatchery stocks throughout this ESU, along with the reduced opportunity for maintenance of locally adapted genetic lineages among different drainages, represents a considerable threat to steelhead in this region (62 Fed. Reg. 43949; August 18, 1997).

The primary cause for concern for steelhead in this ESU is the extremely low estimate of adult replacement rate. The dramatic declines in natural run sizes and inability of naturally spawning steelhead adults to replace themselves suggest that if present trends continue, this ESU will not be viable (62 Fed. Reg. 43950; August 18, 1997).

Steelhead are found throughout the mainstem Chewuch, but it is not known exactly where adult steelhead spawn in the watershed (USFS, 1998). Adult steelhead tend to migrate up the Methow and Chewuch Rivers during spring when water flows are high and turbid, making it difficult to make visual observations of adults or their redds. Steelhead can migrate 35 miles up the Chewuch before reaching a natural barrier falls in the North Cascade Mountains. All of the major tributaries except Lake Creek have a natural barrier falls within ½ mile of their confluence with the Chewuch River. All of the major tributaries have been stocked with rainbow trout (*O. mykiss*), and many have been stocked with steelhead smolts that have residualized (USFS, 1998).

Juvenile steelhead are known to range in the immediate vicinity of the Skyline Ditch headgate (USFS 1998). An USFS electrofish survey conducted on August 11, 1993, in two 150-foot sections of the Skyline Ditch disclosed the presence of seven juvenile steelhead/rainbow trout[1] (USFS, 1998).

[1]Under certain conditions, anadromous and resident *O. mykiss* are apparently capable not only of interbreeding, but also of having offspring that express the alternate life history form, that is, anadromous fish can produce nonanadromous offspring, and vice versa (NMFS 1996a). Mullan *et al.* (1992) found evidence that, in very cold streams, juvenile steelhead had difficulty attaining "mean threshold size for smoltification" and concluded that "Most fish here (Methow River, Washington) that

Historically, fish that had entered the Skyline Ditch through or around the original fish screen were not able to return to the river and would have died when surface water diversion was shut off in fall. These fish might or might not have been direct progeny of the anadromous form.[2]

NMFS believes that resident fish can help buffer extinction risks to an anadromous population by mitigating depensatory effects in spawning populations, by providing offspring that migrate to the ocean and enter the breeding population of steelhead, and by providing a "reserve" gene pool in freshwater that can persist through times of unfavorable conditions for anadromous fish. A particular concern is isolation of resident populations by human-caused barriers to migration. This interrupts normal population dynamics and population genetic processes and can lead to loss of a genetically based trait (anadromy).

B. Upper Columbia River Spring Chinook Salmon

The Upper Columbia River chinook salmon, proposed for listing as endangered pursuant to the ESA on March 24, 1999 (64 Fed. Reg. 14308). Critical habitat for the Upper Columbia River spring chinook salmon was designated on February 16, 2000 (65 Fed. Reg. 7764). The listing status, biological information, and other information for the Upper Columbia River spring chinook salmon are further described in Attachment 2.

The species status reviews (NMFS 1998a, 1998b) cited references indicating that habitat degradation is the major cause for the range-wide decline in west coast chinook salmon stocks. Habitat alterations that have affected chinook salmon include water withdrawal, conveyance, storage, flood control (resulting in insufficient flows, stranding, juvenile entrainment, and increased stream temperatures), logging and agriculture (resulting in loss of large woody debris, sedimentation, loss of riparian vegetation, and habitat simplification) (Spence *et al.*, 1996; NMFS 1998a). Dams, mining and urbanization have also contributed to the partial depletion or extinction of certain chinook salmon stocks.

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do not emigrate downstream early in life are thermally-fated to a resident life history regardless of whether they were the progeny of anadromous or resident parents."

[2]"While conclusive evidence does not yet exist regarding the relationship of resident and anadromous *O. mykiss*, NMFS believes available evidence suggests that resident rainbow trout should be included in listed steelhead ESUs in certain cases. Such cases include (1) where *O. mykiss* have the opportunity to interbreed with anadromous fish below natural or man-made barriers; or (2) where resident fish of native lineage once had the ability to interbreed with anadromous fish but no longer do because they are currently above human-made barriers, and they are considered essential for recovery of the ESU." (62 Fed. Reg. 43941; August 18,1997) NMFS concluded that Upper Columbia River resident *O. mykiss* should not be included in the listed ESU.

Other range-wide factors that impact indigenous west coast chinook salmon stocks include introduced or artificially propagated hatchery stock, harvest, alteration of estuarine habitat, and natural fluctuations in marine environments (Healy 1991, NMFS 1998a, 1998b).

Spring chinook salmon of this listed ESU that are likely to be adversely affected by the proposed action are present in the Chewuch River, a tributary to the Methow River. The Upper Columbia River spring chinook salmon ESU occupies the Columbia River Basin upstream from Rock Island Dam to the United States - Canada border. The geographic area occupied by this ESU forms part of the larger Columbia Basin Ecoregion (Omernik 1987). The Chewuch River is located in the Okanogan Highlands Physiographic Province, and includes stream-type chinook salmon that spawn upstream of the Rock Island Dam in the Wenatchee, Entiat, and Methow Rivers and their tributaries. The climate in this area includes extremes in temperatures and precipitation, with most precipitation falling in the mountains as snow. Streamflow in this area is provided by melting snowpack, groundwater, and runoff from alpine glaciers.

The proposed action would occur within designated critical habitat for the Upper Columbia River spring chinook salmon. Defining specific river reaches that are critical for spring chinook salmon is difficult because of the current low abundance of the species and of our imperfect understanding of the species' freshwater distribution, both current and historical (65 Fed. Reg. 7764; February 16, 2000).

The NMFS' preferred approach to identifying the freshwater and estuarine portion of critical habitat is to designate all areas (and their adjacent riparian zones) accessible to the species within the range of each ESU (65 Fed. Reg. 7764; February 16, 2000). NMFS believes that adopting a more inclusive, watershed-based description of critical habitat is appropriate because it (1) recognizes the species' use of diverse habitats and underscores the need to account for all of the habitat types supporting the species' freshwater and estuarine life stages, from small headwater streams to migration corridors and estuarine rearing areas; (2) takes into account the natural variability in habitat use (e.g., some streams can have fish present only in years with plentiful rainfall) that makes precise mapping difficult; and (3) reinforces the important linkage between aquatic areas and adjacent riparian/upslope areas (65 FR 7764; February 16, 2000).

Essential features of spring chinook salmon critical habitat include adequate substrate, water quality, water quantity, water temperature, water velocity, cover/shelter, food, riparian vegetation, space and safe passage conditions. Good summaries of these environmental parameters and freshwater factors that have contributed to the decline of spring chinook salmon and other salmonids can be found in reviews by CACSS, 1988; Brown and Moyle, 1991; Bjornn and Reiser, 1991; Nehlsen *et al.*, 1991; Higgins *et al.*, 1992; California State Lands Commission (CSLC), 1993; Botkin *et al.*, 1995; NMFS, 1996; NMFS 1998a and 1998b; and Spence *et al.*, 1996.

Artificial propagation efforts have had a significant impact on spring-run populations in this ESU, either through hatchery based enhancement or the extensive trapping and transportation activities associated with the GCFMP (65 Fed. Reg. 7764; February 16, 2000). Prior to the implementation of the GCFMP, spring-run chinook salmon populations in the Wenatchee, Entiat, and Methow Rivers were at severely depressed levels (Craig and Suomela, 1941). Therefore, it is probable that the majority of returning spring-run adults trapped at Rock Island Dam for use in the GCFMP were probably not native to these three rivers (Chapman *et al.*, 1995). All returning adults were either directly transported or spawned in one of the National Fish Hatcheries built for the GCFMP.

In the years following the GCFMP, several stocks were transferred to the hatcheries in this area. Naturally spawning populations in tributaries upstream of hatchery release sites have apparently undergone limited introgression by hatchery stocks, based on coded wire tag recoveries and genetic analysis (Chapman *et al*., 1995). Artificial propagation efforts have recently focused on supplementing naturally spawning populations in this ESU (Bugert, 1998), although it should be emphasized that these naturally spawning populations were founded by the same GCFMP homogenized stock. Furthermore, the potential for hatchery-derived non-native stocks to genetically impact naturally spawning populations exists, especially given the recent low numbers of fish returning to rivers in this ESU (65 Fed. Reg. 7764; February 16, 2000).

Previous assessments of stocks within this ESU have identified several as being at risk or of concern. Nehlsen *et al.*, (1991) identified six stocks as extinct. Washington Department of Fisheries *et al.*, (1993) considered nine stocks within the ESU, of which eight were considered to be of native origin and predominantly natural production. The status of all nine stocks was considered depressed. Populations in this ESU have experienced record low returns for the last few years (65 Fed. Reg. 7764; February 16, 2000).
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Recent total abundance of the Upper Columbia River spring chinook salmon ESU is quite low, and escapements in 1994-1996 were the lowest in at least 60 years (65 Fed. Reg. 7764; February 16, 2000). At least 6 populations of spring chinook salmon in this ESU have become extirpated and almost all remaining naturally-spawning populations have fewer than 100 spawners (65 Fed. Reg. 7764; February 16, 2000). In addition to extremely small population sizes, both recent and long-term trends in abundance are downward, some extremely so. The Washington State Salmon and Steelhead Stock Inventory (SASSI, 1992) lists the Chewuch River spring chinook population as depressed based on a short-term decline in escapement. Stock performance over the past decade would warrant a “critical” designation as defined in the SASSI.

Approximately 25 percent of the adult spring chinook salmon that return to the Methow Basin spawn in the Chewuch River (USFS 1998). The bulk of the spawning habitat occurs from below Eightmile Creek upstream to about Thirtymile Creek, with the largest concentration of spawning occurring between Doe Creek and Falls Creek (USFS 1998). However, a spring chinook spawning survey (Kohn, M., 1988) conducted for the Yakama Indian Nation, counted spring chinook redds starting from about RM 2 and extending upstream throughout the accessible reaches of the Chewuch.

Because of poor returns of adult spring chinook salmon to the Upper Columbia River ESU during the last several years, the fish have been captured at the Wells Dam on the Columbia River and have been used to artificially supplement naturally spawning populations in this ESU. However, preliminary indications are that sufficient numbers of adult spring chinook salmon will be returning this year to allow passage of fish to the tributary systems to naturally spawn. If adequate instream flows are available, it is possible that some of those returning fish might attempt to spawn naturally in the Chewuch.

The mainstem Chewuch provides important rearing habitat for juvenile spring chinook throughout all thirty miles of accessible habitat (USFS 1998), including the project area. An electrofishing survey conducted by the USFS on August 11, 1993 in two 150-foot sections of the Skyline Ditch (below the fish screens) showed the presence of 3 juvenile spring chinook salmon.

C. Biological Requirements

The listed species' biological requirements can be described in a number of different ways. For example, they can be expressed in terms of population viability using such variables as a ratio of recruits to spawners, a survival rate for a given life stage (or set of life stages), a positive population trend, or a threshold population size. Biological requirements can also be described as the habitat conditions necessary to ensure the species' continued existence (*i.e.*, functional habitats) and these can be expressed in terms of physical, chemical, and biological parameters. The manner in which these requirements are described varies according to the nature of the action under consultation and its likely effects on the species (See Attachment 2).

The relevant biological requirements are those necessary for the listed species to survive and recover naturally reproducing population levels at which protection under the ESA would become unnecessary. Adequate population levels must safeguard the genetic diversity of the listed stocks, enhance their capacity to adapt to various environmental conditions, and allow them to become self-sustaining in the natural environment.

For this consultation, NMFS finds that the biological requirements for both Upper Columbia River steelhead and spring chinook salmon are best expressed in terms of environmental factors that define flow, habitat quantity, and water temperature attributes necessary for survival and recovery of the species. These factors are described to the extent possible in below under "Effects of the Action" section. NMFS recognizes that a range of results has been reported for some of the factors, and that definitive information might not exist for all species at all life stages. Also, other environmental factors including suitable ocean conditions, freshwater habitat access, physical habitat elements, channel condition, hydrology, and properly functioning watersheds, where all of the individual factors operate together to provide healthy aquatic ecosystems, are also necessary for the survival and recovery of the listed species.

IV. ENVIRONMENTAL BASELINE

The environmental baseline represents the current basal set of conditions to which the effects of the proposed action are added. The term "environmental baseline" means "the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in process." 50 C.F.R. § 402.02. The term "action area" means "all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action." Id.

Critical habitat for both the steelhead and spring chinook salmon extends to the mainstem Chewuch and to all tributaries where anadromous fish range. Indirect effects within the action area extend down the Chewuch River from the Skyline Ditch diversion at RM 7.5, and some distance downstream from the Chewuch's confluence with the Methow River. The precise downstream limit of the action area cannot be easily determined because of the variable extent of indirect effects.

The Chewuch River watershed is a 5th field tributary to the Methow River. The USFS manages approximately 320,000 acres of the watershed. Of this, about 108,000 acres are in the Pasayten Wilderness located near the Canada border. Other lands in the watershed include 5,000 acres managed by WDFW and another 15,000 acres of privately managed lands, located mainly within the lower reaches of the watershed (USFS 1998).

The watershed's lowlands contain a mixture of agricultural land, meadows, and ponderosa pine and Douglas-fir forests. Land uses within the watershed include timber harvest, grazing, agriculture, and recreation. Federal land uses within the watershed accord with the PACFISH strategy or the Northwest Forest Plan. National Forest System lands located west of the Chewuch River at Lake Creek are managed under the Northwest Forest Plan. National Forest System lands located east of the Chewuch River are managed under PACFISH. The proposed special use permit site is located in lands managed under the Northwest Forest Plan (USFS 1998).

Access to a substantial portion of historical habitat for both steelhead and spring chinook salmon is blocked by the construction of Chief Joseph and Grand Coulee Dams on the mainstem Columbia River. For both the Upper Columbia River steelhead and spring chinook salmon ESUs, there are also local habitat problems related to irrigation diversions, degraded riparian and instream habitat from urbanization, land conversion to crops and orchards, livestock grazing, and timber harvest (NMFS 1996a, 1996b, 1997, 1998a, 1998b).

The relationship between groundwater and surface flow in the Methow Basin is complex. Surface flow in the Methow River can intermittently disappear and reappear in different reaches as it flows downstream. Groundwater can reverse its direction of flow as the water level drops in the Methow River and it is uncertain into which aquifers and streams water goes when the irrigation diversions cease

(Caldwell and Catterson, 1992). Because of the hydrologic continuity of surface and groundwater in the basin, some believe that a large portion of the water diverted for agricultural or other domestic purposes returns to the Methow or the Columbia River. As a result, returning water is available for other uses (i.e, riparian vegetation watering, fish use, etc.) within the basin (Mullan et al., 1992). However, NMFS generally believes that diverting flow from streams and rivers contributes to the degraded environmental baseline conditions for listed anadromous fish within stream segments that could be used by fish if conditions were suitable.

The Methow Basin, including the Chewuch watershed, is dominated by glacial outwash sands and decomposed granitic parent material. Sand is a major component of the channel and bank substrate. Highly erosive soils are common and occur in both wilderness and non-wilderness reaches (USFS, 1998). Glacial deposits of sands and gravels make up the principal Methow Valley aquifer. These substrates are so porous and permeable that a high degree of hydraulic continuity is virtually guaranteed as the ground water and surface water exchange rapidly under certain conditions (Peterson and Larson, 1991). For example, snowmelt in the spring creates high flow levels in the Methow River which caused water levels in wells in the Early Winters area to rise 10 to 25 feet in a one- to two-week period (Golder Associates, 1991). Conversely, during drought or low flow years, certain reaches of tributary streams and rivers to the Methow and reaches of the Methow River itself can go dry under natural conditions (without diversions) (EMCON 1993).

High hydraulic continuity is evident in certain reaches of the mainstem Methow River upstream of the Weeman bridge (RM 59.7) that exhibit no surface flow during drought years from August through October. These reaches also freeze solid from December through February. In these reaches, the upper water level of the ground water aquifer is the same as the surface water level in the Methow River. Therefore, when the ground water aquifer level drops by the extent of the Methow River's water depth (as occurs during well pumping), surface flow in the Methow River goes subsurface causing the reach to appear dry (Caldwell and Catterson, 1992).

Winter anchor ice[3] is another environmental baseline condition that occurs in the Methow River and certain other tributaries. This condition can force juvenile steelhead and spring chinook salmon to seek areas that remain ice-free to survive. Though the extent of damage from anchor ice on critical habitat is unknown, NMFS assumes winter freezing conditions contribute to the degraded environmental baseline.

Most of the Chewuch River watershed is located within the Okanogan National Forest. Most of the

[3]During drought years and winter freezing conditions certain reaches of the Methow River and some tributaries can ice over from December through February. In addition, Caldwell and Catterson (1992) noted on January 30, 1992 that certain reaches of the Methow River had no surface flow but had one foot of ice covering the streambed.

lower watershed in the lower seven miles of the Chewuch is privately owned. Historically, these lands have been intensively managed, leading to generally degraded steelhead and spring chinook salmon habitat. Land uses and management activities that have degraded habitat in this watershed include water withdrawals, unscreened water diversions, road construction, timber harvest, conversion of land to agriculture or orchards, livestock grazing, real estate development and urbanization (NMFS 1996a, 1996b, 1997, 1998a, 1998b). In this watershed (and throughout the range of both Upper Columbia River steelhead and spring chinook ESU's) land management activities have: (1) reduced connectivity (i.e., the flow of energy, organisms, and materials) between streams, riparian areas, floodplains, and uplands; (2) elevated fine sediment yields, filling pools and reducing spawning and rearing habitat; (3) reduced instream and riparian large woody debris that traps sediment, stabilizes streambanks, and helps form pools; (4) reduced or eliminated vegetative canopy that minimizes temperature fluctuations; (5) caused streams to become straighter, wider, and shallower, which has the tendency to reduce spawning and rearing habitat and increase temperature fluctuations; (6) altered peak flow volume and timing, leading to channel changes and potentially altering fish migration behavior; (7) altered floodplain function, water tables and base flows, resulting in riparian wetland and stream dewatering; and (8) degraded water quality by adding heat, nutrients and toxicants (NMFS 1996a, 1996b, 1997, 1998a, 1998b; FEMAT 1993, USDA U.S. Forest Service 1993, National Research Council 1996, Spence *et al.*, 1996).

Past timber harvest has led to extensive road networks in the watershed. There are over 579 miles of open road and 74 miles of closed road in the Chewuch watershed. About 160 miles of these roads are within 200 feet of streams in the drainage (USFS 1998). There are also over 1,000 stream crossings in the watershed. (Chewuch Watershed Assessment, 1994). Roads parallel both sides of the lower twenty-five miles of the Chewuch. Valley bottom roads are in place along most of Cub, Boulder, Eightmile, and Falls Creeks, and the lower two miles of Lake Creek (USFS 1998). Roads in the watershed can affect peak flows through increased drainage in the watershed (Wemple et al., 1996). In addition to altered flows, increased sedimentation from road surface erosion can disrupt spawning, migration and other flow-dependent fish behavior. Such disruption can diminish spawner productivity (Spence et al. 1996).

There are 48 miles of stream accessible to anadromous fish in the watershed, 35 miles of which have roads on each side of the stream. The upper half of the watershed is unroaded in contrast to the more intensely managed lower watershed. Roads, timber harvest, and livestock grazing take place in the lower half of the watershed where soil erosion and sediment delivery rates are naturally high and easily accelerated by management activities (USFS 1998).

In addition to the Skyline Ditch, there are two additional irrigation diversion ditches located on National Forest lands at Eightmile Creek, a tributary to the Chewuch River. Together, those two ditches divert up to 4.5 cfs. There are also three water transmission lines (up to 1 inch diameter hose lines) located in Brevicomas and Cub creeks, tributaries to the Chewuch River. Those water transmission lines collectively use considerably less than 1 cfs. Those diversions and water transmission lines are the subject of other consultations with the USFS. The Chewuch River is dammed in two locations outside of the National Forest. Each dam is associated with a water diversion and a fish ladder that does not impede adult salmon or trout passage (USFS 1998). The Chewuch Canal diversion (30 cfs) is located on the Chewuch River at RM 8.1 and the Fulton Canal diversion (27 cfs) is located at RM 0.9. Together these diversions withdraw an average of 57 cfs (Caldwell and Catterson 1992).

Irrigation withdrawals can vary from year to year. For instance, irrigation withdrawals were removing 87.1 cfs from the Chewuch River in 1971 (The Pacific Northwest River Basin Commission [1977] as cited by Caldwell and Catterson 1992)). In the summer of 1991, an average of 73 cfs was withdrawn from the four largest ditches in the Chewuch, which includes the Fulton, Chewuch, Eightmile and Skyline (Caldwell and Catterson, 1992). An U.S. Geological Survey (USGS) measuring gauge was installed in 1991 at RM 0.2 that measures flows continuously and from which daily averages are published. This relatively short and incomplete period of record does not cover the full range of natural variability of climate and water yield, so the lack of comprehensive data limits a full analysis of expected flows.

Flows, as measured at the USGS gauge at RM0.2, can vary dramatically by season, with the highest flows occurring towards the end of May and early June (up to 4,400 cfs in 1996). Low base flow conditions occur in September and/or in February and have been measured as low as 25 cfs in September 1994, and a low of 52 cfs on September 25, 1995. Both measurements included diversions (USGS, 1994 and 1996).

Minimum instream flows for the Chewuch River were adopted by WDOE in December 1976 (Caldwell and Catterson 1992). Although minimum flows were established, those flows only apply to water rights which were established after 1976 (USFS 1998). The minimum instream base flow set by WDOE for the Chewuch from August 15 through September 15 is 47 cfs (USFS 1998). However, that minimum instream flow was established by WDOE at RM 8.7, immediately above the Chewuch Canal (RM 8.1) and Skyline Ditch (RM 7.5) diversions. Those two diversions alone were measured by WDOE on August 28, 1991 to divert 46 cfs from the Chewuch. Flow data for 13 years cited in Mullan et al. (1992) also found August and September flows at RM 8.8 (presumably above all diversions) ranging from 0 to 313 cfs, with flows less than 46 cfs in five years. This information shows that during drought or certain late summer-early fall periods when natural (*i.e.*, undiverted) river flows measure an estimated 100 cfs, approximately 80 percent (80 cfs) or more of the available surface flow could be diverted from the lower river if all diversions (including Eightmile Creek Ditch[4]) are in operation. Periodically, during diversion operations, minimum instream flows are not met.

The lack of comprehensive data limits a full analysis of expected flows. However, the available information shows that during drought or certain late summer-early fall periods when natural (i.e.

[4] Eightmile Ditch also requires a USFS special use permit and has been evaluated under separate section 7 consultation and is not a part of this consultation.

undiverted) stream flows could measure 46 cfs or less, up to 100 percent of the surface flow could be diverted from the river prior to its confluence with the Methow River. There have been periods during the late summer-early fall baseflow conditions when diversions are in operation that the lower reach of the Chewuch River has gone dry. It is for this reason the Chewuch River is on the Clean Water Act 303(d) list as impaired for instream flows.

Based on all the above information, the NMFS concludes that not all of the biological requirements of the listed steelhead and spring chinook salmon for freshwater habitat in general, and for flows in particular, are being met under the environmental baseline in this watershed. The status of the species is such that there must be significant improvement in the environmental conditions they experience, over those presently available under the environmental baseline, to meet the biological requirements for survival and recovery of these species. Further degradation of these conditions could significantly reduce the likelihood of survival and recovery of these species due to the amount of risk the listed steelhead and spring chinook salmon already face under the current environmental baseline.

V. EFFECTS OF THE ACTION

NMFS' ESA implementing regulations define "effects of the action" as "the direct and indirect effects of an action on the species or critical habitat together with the effects of other activities that are interrelated or interdependent with that action, that will be added to the environmental baseline." (50 C.F.R. § 402.02). "Indirect effects" are those that are caused by the proposed action and are later in time, but still are reasonably certain to occur (*ibid*). For this proposed action, no direct effects upon listed fish result from issuance of the requested special use permit. The effects on listed fish result from operation of the Skyline Ditch under the permit, and are therefore indirect effects of issuing the permit.

The Okanogan National Forest determined the proposed action was likely to adversely affect both listed steelhead and spring chinook salmon. Since that determination of effect, NMFS designated critical habitat for both species (65 Fed. Reg. 7764; February 16, 2000). Critical habitat includes habitat in the action area for this action.

The Okanogan National Forest (USFS 1998 and 2000) considers the following to be adverse effects to the steelhead and spring chinook salmon resulting from the proposed action: (1) potentially diverting up to 17 cfs of water during late summer-early fall baseflow conditions can result in dewatering redds and/or a reduction in egg-to-smolt fish survival through adverse habitat modification or destruction, and 2) the water diversion can exacerbate thermal and/or low barriers that delay or inhibit migration of spring chinook salmon returning to spawn.

The USFS applied NMFS' evaluation methodology (NMFS 1996c) to assess the current environmental baseline of the Chewuch River watershed and summarized the expected effects from the proposed action on the environmental baseline. The USFS found that for steelhead and spring chinook, peakflows, baseflows, and temperature would be degraded from their already "not properly functioning"[5] environmental baseline condition. The USFS also found that physical habitat indicators including pool frequency, pool quality, off-channel habitat, channel width/depth ratio, and floodplain connectivity within the action area would be further degraded by ditch operations from their already "at risk" environmental baseline.

In reviewing the effects of this action on listed species and designated critical habitat, NMFS evaluated effects to the three essential features of critical habitat most affected by the proposed action (65 Fed. Reg. 7764; February 16, 2000). These features include (1) streamflow conditions, (2) habitat quantity and quality, and (3) water temperature. These effects are discussed below.

A. Streamflow Conditions

Snow melt and glaciers are the primary sources of water in this watershed, and water flows can naturally increase rapidly depending on the size of the snowpack and occurrence of warmer weather. Water depth and current velocity are two elements of spawning habitat that relate directly to streamflow. Salmonids typically deposit eggs within a range of depths and velocities that minimize the risk of dessication as water level recedes. These locations ensure the exchange of water between surface and substrate interstices is adequate to maintain high oxygen levels and remove metabolic wastes from the redd (Spence *et al.*, 1996). Most species typically spawn at depths greater than 15 cm. Smaller trout will spawn in shallower waters (Thompson 1972). If diversion ditches are turned on during April-May, and winter baseflow conditions are still in effect, redds located in shallower depths could be dewatered.

Streamflow is important in facilitating downstream movement of salmonid smolts. Dorn (1989) found that streamflow increases triggered downstream movement of coho salmon in a western Washington stream. Similarly, Spence (1995) also found short-term flow increases are an important stimulus for smolt migration in four populations of coho salmon. Chinook salmon can gradually move downstream over several weeks or months. Different behaviors entail substantially different habitat requirements during the migration period (Spence *et al.*, 1996). Thus the normal range of streamflows might be required to maintain normal temporal patterns of migration in a particular basin. Streamflow is also important in determining the rate at which smolts move downstream, although factors influencing the speed of migration remain poorly understood (Spence *et al.*, 1996).

For salmon and other aquatic organisms, flows determine the amount of available water, the types of micro-and macrohabitats, and the seasonal patterns of disturbance to aquatic communities (Spence *et al.*, 1996). High-flows redistribute sediments in streams, flushing fine sediments from spawning gravels and allowing recruitment of gravels to downstream reaches. Extreme high flows are essential for

[5]The terms "not properly functioning" and "at risk" refer to determinations by the agency proposing the action and are described in NMFS 1996c.

developing and maintaining healthy floodplain system. Extreme high flows move and deposit sediment, recharge groundwater aquifers, disperse vegetation propagules, and recruit and transport large woody debris (Spence *et al.*, 1996). Low flow conditions can reduce the amount of refugia from predators and elevated water temperatures, reduce the availability of food, and increase competition for space and food sources (Gregory & Bisson 1997). Natural flow variations happen occasionally, increasing surface flows for a few days. Typically these variations do not make up for normal low flows in late summer and early fall.

The number of spawning salmon and trout that can be accommodated in a given stream depends on the availability of suitable habitats for redd construction, egg deposition, and incubation (Bjornn and Reiser 1991). In general, the amount of habitat suitable for spawning increases with increasing streamflow. However, excessively high flows can cause scouring of the substrate, resulting in injury or death to developing embryos and alevins (Hooper 1973).

Where water is withdrawn from smaller rivers and streams, seasonal or daily flow fluctuations can adversely affect fish, macroinvertebrates in littoral areas, aquatic macrophytes, and periphyton (reviewed in Ploskey 1983). Fluctuating water levels can delay spawning migrations, impact breeding condition, reduce salmon spawning area (Beiningen 1976), dewater redds and expose developing embryos, strand fry (CRFC 1979), and delay downstream migration of smolts. The literature suggests that irrigation diversions contribute to low flows and are likely to inhibit or delay salmonid smolt migration. This delay could limit fish survival and reduce potential numbers of returning adults (NPPC 1986).

Water withdrawals affect the quality of pools in the lower eight miles of the Chewuch by reducing depth and wetted area and width. Among juvenile salmonids this can result in increased competition for food, reduced dissolved oxygen levels, increased physiological stress, and vulnerability to predators. When seasonal low flows occur, deep pools with cool-groundwater inputs are needed to provide the necessary cover and thermal refugia for juvenile salmonids.

Off-channel habitat in the Chewuch provides important thermal refuge from high summer and cold winter temperatures in the lower 20 miles of the main Chewuch channel. Water diversion contributes to low flow conditions in the lower eight miles of the Chewuch that can cause dewatering of off-channel habitat and a reduction in the quality and quantity of refugia habitat available for juvenile salmonids. The Chewuch is considered to provide some of the most important refugia habitat for spring chinook salmon in the Methow basin (USFS 1998).

Irrigation withdrawals in the lower Chewuch River, when coupled with seasonal low flow conditions, could cause groundwater beneath the floodplain to flow toward the river, resulting in drier conditions under the floodplain along the Chewuch. Lowered groundwater levels can reduce riparian habitat within the floodplain, potentially limiting shade, food, detrital sources, and future large woody debris input. This phenomenon was noted by Caldwell and Catterson (1992) as occurring along the Methow

River.

Irrigation diversions in the Chewuch subbasin generally begin in mid-April, continue throughout the summer, and end in mid-October of each year. Irrigation diversion start-up usually coincides with steelhead upstream migration into the Methow River (mid-March through May). Steelhead spawning in the upper mainstem and tributaries (Chewuch) occurs from April into July (USFS 1998).

Skyline Ditch operates when spring chinook salmon return to spawn (August-September). The Skyline Ditch historically diminished instream flows, leading to inhibited upstream migration, reduced available spawning and rearing habitat, and elevated water temperatures above the preferred range optimal for spawning and egg survival (USFS 1998).

The Chewuch is on the Clean Water Act 303(d) list as being impaired for instream flow because of irrigation withdrawals. Flows vary dramatically by season, with the highest flows occurring towards the end of May and early June (up to 4,400 cfs in 1996) (USFS 1998). Lowest low flows ("baseflows") occur in September and/or in February. Flows reached a low of 24 cfs on September 30, 1994 and a low of 52 cfs on September 25, 1995 (USGS website). Skyline's proposed diversion of up to 17 cfs is about 21 percent of the combined 80 cfs recently diverted from the Chewuch. The Skyline Ditch would divert approximately 16 percent of the natural summer baseline flow (without diversions) in the Chewuch.

The effect of irrigation on flows is documented in data collected at the USGS gauge at RM 0.2. In 1995 flow increased after ditch turn-off from 54 cfs on September 27 to 104 cfs on October 3. Historically, the Skyline Ditch diverted up to 26 cfs, or 28 to 35 percent of the total 73 to 90 cfs diverted from the Chewuch River (USFS 1998, Richardson 1976 cited in Mullan et al 1992). Few historical records (hydrograph or other flow data) exist to show the total seasonal average irrigation withdrawals from the Chewuch over the years. However, available records show a seasonal average of 87.1 cfs was diverted in 1971 and 73 cfs was diverted in the summer of 1991 (Caldwell and Catterson, 1992). Collectively, the irrigation diversions along the lower nine miles of the Chewuch can remove up to 80 percent of the total instream flow available during the late summer-early fall season in a normal water year.

Washington Department of Ecology conducted an Instream Flow and Incremental Methodology (IFIM) study for the Methow River Basin was conducted by WDOE (Caldwell and Catterson, 1992), and included a study site at RM 1.3 on the Chewuch River (within the action area). That study found that the highest quantity of habitat occurs at flows of 425 cfs for steelhead spawning, at 275 cfs for spring chinook salmon spawning, at 400 cfs for juvenile steelhead rearing, and 150 cfs for juvenile spring chinook rearing. The lower Chewuch does not usually meet those flows from August through the winter. Water withdrawals exacerbate low flows during this time period (Caldwell and Catterson, 1992).

The removal of up to 17 cfs during baseflow conditions would appreciably reduce flows in the lower 7.5 miles of the river. In the mainstem Chewuch River, where approximately 35 miles of habitat is accessible to anadromous fish, this affected distance of river would equal 20 percent of the total reach of the river available for spring chinook spawning and rearing. Skyline Ditch operations during the late summer/early fall would further degrade already sub-optimal flows.

Based on 1991 50% exceedence-frequency hydrograph data[6] for the Chewuch River gauge, optimal flows for steelhead rearing would naturally recede below 400 cfs about the third week in July and remain sub-optimal through the winter (Caldwell and Catterson, 1992). Operation of the Skyline Ditch would further degrade natural low summer baseflow habitat conditions for juvenile steelhead from late July through the ditch turn-off date in mid-October. For rearing juvenile spring chinook salmon, ditch operation would degrade low baseline flow conditions below optimum levels (<150 cfs) by late August or early September. Low flows can cause temporary flow and thermal barriers that hinder returning spring chinook salmon.

Peak- and baseflows are not properly functioning for the lower eight miles of the Chewuch River (USFS 1998). The proposed action maintains or further degrades the environmental baseline. The proposed action is inconsistent with the Peak/Baseflow indicator of the Aquatic Conservation Strategy Objectives of the Northwest Forest Plan for salmonid fish habitat protection (USFS 1998). This means that watershed-scale conditions favorable to healthy populations of native salmonids are absent hindering recovery of listed fish.

Particular streamflow effects on each of the two listed species are discussed below.

1. Upper Columbia River Steelhead

Using the IFIM optimum curves for weighted usable area and the 1991 50% exceedence-frequency hydrograph (Caldwell and Catterson 1992), optimal flow conditions for spawning steelhead are approximately 425 cfs. In average flow years, river flow would drop below 425 cfs about the third week in July and continue to drop until ditch turn off in mid-October (Caldwell and Catterson 1992; Golder Associates, Inc. 1993). In the upper Methow Basin watersheds, including the Chewuch, steelhead spawning can continue into July (USFS 1998). Embryos develop for a period of one to several months, depending on water temperature and dissolved oxygen availability, before hatching occurs. Incubating eggs or alevins (hatched larval stage fish) would still be in the gravels when flows would naturally begin dropping below optimal conditions. Operating the Skyline Ditch diversion would further exacerbate declining or low base flow conditions and could limit available spawning areas, and contribute to dewatering incubating steelhead eggs, or more likely, the stranding of alevins still in the gravel, potentially resulting in hindered embryonic development and direct injury or death . Steelhead

[6] 50% exceedence flow is equaled or exceeded 50% of the time. This can also be thought of as a 5-in 10-year low flow.

can also be at a higher risk for egg or alevin dewatering/stranding because spawning fish can deposit their eggs at the margins of streams.

Caldwell and Catterson (1992) also concluded the optimal river flow conditions for juvenile steelhead rearing habitat are approximately 400 cfs. In average flow years, the Chewuch would drop below 400 cfs by the end of July. In 1994, gauged river flows at RM 0.2 had dropped to 69.4 cfs by the first week in October, and 24 cfs prior to the fall ditch shut-off date (USGS 1994). Operation of the Skyline Ditch to divert water would contribute to the already naturally declining instream flows; thus decreasing the quantity of refugia habitat available to juvenile steelhead to avoid predators, reducing the availability of food, and concentrating fish to compete for space and food.

Minimum depth for steelhead passage is about 18 cm (seven inches) (Thompson 1972, Bjornn and Reiser 1991). Fish might need greater pool depth to negotiate large barriers (Stuart 1962). The ability to pass a barrier is also influenced by pool configuration. Less severe inclines can be more difficult to pass if pool depths are inadequate and flow velocities are high (Stuart 1962). Winter-spring flow conditions in the Chewuch River will not impede returning adult steelhead.

Migrating juvenile fish are particularly vulnerable to predation. The lower reach of the Chewuch watershed has been modified by land management actions that have removed habitat complexity (riparian vegetation and large woody debris) needed for juvenile salmonids (USFS 1998). Low baseflow conditions exacerbated by water diversions in the action area would increase competition among juvenile steelhead for shelter/cover, food, and space. Baseline conditions exacerbate vulnerability to predation, and flows under the proposed action would further increase vulnerability to predation.

Evidence suggests that juvenile steelhead in the Methow River that do not attain mean threshold size for smoltification because of cold water temperature will remain a resident in freshwater. Thus, steelhead likely reside year round in the Chewuch and might need to seasonally migrate up or downstream in search of food, cover, or to avoid seasonal stranding. In drought years or during seasonal low baseflow conditions, water diversions in the action area could inhibit or prevent the upstream or downstream passage of juvenile fish.

Most of the habitat indicators in the environmental baseline for the lower Chewuch River watershed are “at risk” or “not properly functioning” for steelhead. Furthermore, the proposed action would further degrade instream flows. Therefore, NMFS strongly believes that for this action, restoring flows is the single most important habitat feature that would promote conservation of the species under ESA and aid in the long-term restoration of habitat.

2. Upper Columbia River Spring Chinook Salmon

The effects of low flows on steelhead are similar to those effects on chinook salmon. Generally, chinook will spawn in water depths from a few centimeters to several meters (Bell 1991). Optimum spawning depths for chinook are 0.8 ft (9.6 inches) (Thompson 1972).

The IFIM study concluded that optimal instream flows for spring chinook salmon spawning habitat in the Chewuch are 275 cfs (Caldwell and Catterson, 1992). Based on the 1991 50% exceedence-frequency hydrograph (which includes diversions), flows averaged about 235 cfs during the first week of August. By the first week in October, river flows had dropped to 69 cfs, a decline of 165 cfs or 70 percent. For the same period in 1994, flows dropped to 24 cfs. Those declining flows to seasonal low baseflow conditions would coincide with the arrival of spring chinook returning to spawn in the Chewuch. According to observations in 1987, spring chinook spawned in the lower Chewuch (action area) reaches from August 18 to September 8 (Caldwell and Catterson, 1992).

During the 1987 spawning period, irrigation diversions removed more than half of the available surface flow from the lower eight miles of the river. Diversion probably reduced the availability of spawning habitat and elevated water temperatures. These effects probably impeded or prevented successful spawning and egg development. Furthermore, these effects probably delayed migration, reducing spawner productivity. Under the proposed operation, Skyline Ditch would remove 27 to 34 percent of the surface flow available in the Chewuch during low flow periods during most years. The fraction of Chewuch flow removed by Skyline Ditch would increase during low-water years.

Stream conditions during incubation can have a dramatic effect on the survival of incubating eggs. Experiments by Gangmark and Broad (1955) and Gangmark and Bakkala (1960) in Mill Creek, California, demonstrated that aside from large floods, chinook egg fatality was associated with low oxygen in the spawning gravel (less than 5ppm) and poor percolation of water through spawning gravel (Groot and Margolis, 1991). Adequate water percolation through the spawning gravels is essential for egg and alevin survival. Becker et al. (1982, 1983) investigated the effects of dewatering artificial chinook redds on survival and development rate of embryos at various stages of development. Alevins were most sensitive to both periodic short-term dewatering and a prolonged single dewatering, surviving at less than 4 percent in periodic dewaterings of one hour or a single dewatering of six hours (Groot and Margolis, 1991). The development rate of embryos was also reduced in those instances in which survival was affected but not in instances when survival was good (Groot and Margolis, 1991).

The IFIM study (Caldwell and Catterson 1992) also showed that juvenile rearing flows declined below optimum conditions (150 cfs) by late August, and continued to drop to seasonal baseflows by early October. Irrigation diversion operations would exacerbate these baseflows until ditch turn-off on October 15. Low flows limit the quantity of refugia available for predator avoidance, reduce the availability of food, and increase competition for space and food.

Streamflow during upstream migration must enable passage over physical barriers including falls, cascades, and debris jams. Accordingly, migrations of many stocks coincide with high flows (Spence *et al.*, 1996). Spring and summer chinook adults migrate during periods of high flows that allow them to reach spawning tributaries in headwater reaches, while fall-run stocks, which typically spawn in lower reaches, can enter streams during periods of relatively low flow (Healey 1991).

Minimum passage depth for large chinook salmon is 24 cm (9.4 inches) (Thompson 1972, Bjornn and Reiser 1991). As for steelhead, larger passage barriers require substantially deeper pools (Stuart 1962). Pool configuration also influences passability. Less severe inclines can be more difficult to pass if pool depths are inadequate and flow velocities are high (Stuart 1962). Low instream flow conditions in the Chewuch River can hinder or delay adult spring chinook salmon from entering the river to spawn from late July to September, when irrigation diversions further decrease low flows.

Migrating juvenile chinook are particularly vulnerable to predation. These fish move in concentration through areas with limited cover and many predators. Historic modification through land use activities in the lower Chewuch watershed decreased habitat complexity (riparian vegetation and large woody debris) needed for juvenile salmonids (USFS 1998). Low baseflow conditions exacerbated by water diversions in the action area would increase competition among juvenile spring chinook salmon for shelter/cover, food and space.

Most of the habitat indicators in the lower Chewuch watershed are "at risk" or "not properly functioning" for spring chinook salmon. The proposed action would further degrade instream flows. NMFS strongly believes, within the context of this proposed action, that restoring flows would be the single most important habitat feature that would promote conservation of the species under ESA and aid in the long-term restoration of habitat.

In light of the above information, and the potential for precipitous drops in seasonal Chewuch River flows during and immediately after the period chinook salmon spawn, NMFS believes that operating the Skyline Ditch could significantly contribute to the seasonally declining instream flows, and likely limit the availability of spawning areas and contribute to the dewatering/loss of incubating chinook eggs and/or stranding of alevins still in the gravels.

Finally, it is important to note the relationship between operating irrigation diversions and maintaining in-river flows to protect fish resources, particularly during drought periods or during low base flow conditions. In 1994, the USGS Chewuch River gauge (at RM 0.2) measured 25 cfs instream flow on September 30, 33 cfs on October 1, 54 cfs on October 12, and 102 cfs on October 27 (USGS website). In 1995, instream flow was 58 cfs on October 1 and 104 cfs on October 3 (USGS 1996). According to the BA (USFS 1998), those rapid returns in river flows were directly attributed to the turn-off dates of diversions in the Chewuch. The protection of salmonid habitats requires streamflows to fluctuate within the natural range of flows for the location and season (Spence *et al.*, 1996). Operation of the Skyline Ditch seasonally contributes to the significant removal of surface flow from the Chewuch, affecting the natural hydrograph, which in turn affects fish production and reduces the quantity of habitat available for rearing juvenile salmonids.

3. Groundwater Recharge

There is a widespread belief in the Methow Valley that irrigation water that infiltrates anywhere is quickly returned to streams where that water can support fish and productive fish habitats. No information to verify the claims that groundwater is ubiquitous (such as data control points or gauges) was presented during this consultation. In addition, a search of the literature has found no evidence of any well log data or subsurface well control to verify transmissivity rates that would support that belief.

The IFIM report (Caldwell and Catterson 1992) suggests that aquifers are complex and not well understood for the Methow Valley. According to Mullan, *et. al*. (1992), "available geologic data are inadequate for delineating formations and aquifers that have relatively good or poor water-yielding characteristics in the Methow Valley." Nassar (1973) reported that the actual contribution of return water depends not only on the storage characteristics of the aquifer, but also on the local hydraulic gradient and the degree of transmissivity between the stream and the groundwater. In areas where return flows are suspected (e.g., Early Winters Creek, Chewuch River and the Wolf Creek subbasin) the flows often do not reach the main channel for many miles downstream. The delay in returning flows results in dewatering of stream and tributary habitats (EMCON 1993).

The IFIM report also discusses the effects when ditches are turned off in the fall and water levels in the river do not immediately return to full flows (Caldwell and Catterson 1992). For example, six days after the Chewuch irrigation ditches stopped diverting 64.2 cfs in early October 1991, the flow in the Methow River had increased only 1 cfs compared to flows during diversions (from 228 to 229 cfs). Other observed effects were a recovery of only 39 percent of pre-diversion river flows near Twisp two days after the irrigations were turned off. The authors of the IFIM report speculate that the missing water was still bound in groundwater along the riparian areas, where the demand for bank storage would not be met for some period of time (Caldwell and Catterson, 1992).

The best available information considered for this consultation suggests that operating surface water diversions during low baseflow conditions contribute to a seasonal reduction in the volume of water stored in the riparian groundwater bank. A seasonal reduction in riparian groundwater storage exacerbated by water withdrawals, which coincides with the growing season, could potentially inhibit or prevent riparian vegetation from establishing or obtaining future proper functioning condition because water might not be available to the root zone during the growing season. Thus, the diminished health and lower density of plants, shrubs, or trees (riparian community) that provide bank stabilization, shade, organic debris, food sources (insects), and future large woody debris in the action area can have significant long-term adverse affects to designated critical habitat for both steelhead and spring chinook salmon. The adverse effects on listed fish of reduced groundwater storage during irrigation season likely outweigh any benefits of later groundwater recharge by previously withdrawn water.

B. Habitat Quantity and Quality

The physical structure of streams and rivers play a significant role in determining the suitability of aquatic habitat. Habitat structural elements arise from natural geomorphic features, the power of flowing water, sediments delivered to the channel, and riparian vegetation which provides bank stability and large woody debris inputs (Spence, *et al.*, 1996). Spatial differences and gradients cause a variety of macro- and microhabitat attributes that are used by salmonids at various stages of their life histories. Macrohabitat features include pools, glides, and riffles. The relative frequency of these habitat types changes with the size of the stream, the degree of channel constriction, and the presence of large woody debris (Spence, *et al.*, 1996). Microhabitat attributes include characteristics such as substrate type, cover, depth, hydraulic complexity, and current velocity (Spence *et al.*, 1996).

Ditch operation, especially when conducted during late summer/early fall baseflow conditions, would appreciably diminish both macro- and microhabitat features by reducing the volume and velocity of water in the river. The proposed diversion of up to 17 cfs flow by the Skyline Ditch would represent 21 percent of the combined 80 cfs recently diverted from the Chewuch. That flow volume alone would equal 16 percent of the summer baseline flow of 104 cfs measured in the river on September 30, 1994 (USFS, 1998).

Available data does not enable precise quantification of habitat loss as the result of the proposed action. The generally degraded environmental baseline in the lower Chewuch watershed raises concern regarding any habitat loss from the proposed action. As already discussed, historic water diversion combined with other land use and management activities have caused degradation of habitat by raising water temperatures, eliminating pools, sedimentation, and reducing or eliminating large wood in the Chewuch River. Adding the effects of the proposed water withdrawal to the environmental baseline will further reduce pool frequency and depth, and further degrade habitat quantity in the Chewuch River. Because the environmental baseline conditions in the lower Chewuch watershed are already at risk for salmonids, the proposed water withdrawals during low baseflow conditions by the Skyline Ditch Company would further exacerbate or degrade habitat conditions for salmonids by appreciably reducing the quantity and quality of habitat available for spawning, rearing, cover/shelter, food, and space.

C. Water Temperature

According to the best available information, water temperature can effect smolt migration. Scientists believe priming factors such as photoperiod and temperature regulate smolt migration. Temperature affects migration timing of smolts in two fundamental ways. First, temperature influences the rate of growth and physiological development. Second, temperature affects the responsiveness of fish to other environmental stimuli (Groot 1982). Consequently, alteration of thermal regimes through land use practices and dam operations can influence the timing of migration (Spence *et al*., 1996). Holtby (1988) found that coho salmon smolts emigrated approximately eight days earlier in response to logging-induced increases in water temperature. This data suggests that the habitat disturbances in the lower Chewuch watershed and increased water temperatures exacerbated by irrigation diversion can influence early emigration of juvenile steelhead and spring chinook salmon.

Data for water temperature effects on steelhead and spring chinook salmon for specific river reaches in the action area is not available. The following assessments are based on the spot data collected from July-September, 1989 (Mullan et al., 1992), WDFW in 1994, and USFS in 1996 at RM 7.8 and 8.0 (USFS 1998 and 2000).

1. Upper Columbia River Steelhead

Water diversion would degrade steelhead habitat in the lower 7.5 miles of the Chewuch by affecting water temperature. Water diversion would cause raised temperature when natural flow conditions drop below levels sufficient for maintaining all salmonid life stages (i.e., pre-spawning survival, egg-to-smolt survival, and upstream/downstream migration survival). High spring/early summer flows in the Chewuch enable water temperature below 57°F, the range preferred by steelhead for spawning in spring and early summer (USFS 1998 and 2000). In contrast, operation of the Skyline Ditch during low flow periods (usually late July-October) would contribute to raised water temperature in the lower 7.5 miles of the river. Water temperature data collected by WDFW in August and September 1994 at RM 8, indicated the monthly mean temperatures are at 61.8°F and 61.2°F, respectively (USFS 1998 and 2000). The lower eight miles of the Chewuch are at risk for steelhead rearing and migration in August and September because of elevated water temperature (USFS 1998 and 2000).

In a recent low-water year (1994), the seven-day average maximum temperature was 71.9°F at RM 8 (USFS 1998). This data was collected upstream of the Skyline Ditch (RM 7.5) and Fulton Canal (RM 0.9) diversions. Thus, instream temperatures in certain reaches of the lower Chewuch could have been higher because of decreased instream flows after additional diversions, decreased instream velocity, and longer period of exposure to solar radiation. This is important because if steelhead spawn in the lower eight miles of the river, their eggs would be incubating or alevins would be in the gravels when water temperature would begin to dramatically rise. Bell (1991) reported the preferred egg incubation temperature for steelhead is 10°C (50°F). By comparison with monthly mean temperature data collected at RM 7.8 and 8.0 by WDFW in 1989, 1994, and 1996, the average monthly water temperatures for July-September would exceed the optimum range for steelhead incubation (USFS 1998 and 2000). Raised water temperature can kill eggs or lead to abnormal physical deformities in developing embryos.

In the Methow River tributaries, steelhead alevin emergence from the gravels can extend from July into September. The recorded elevated water temperatures in the lower Chewuch coincides with steelhead fry emergence. Bell (1991) reported the upper lethal (50% fatality) temperature for steelhead is 24°C (75°F). The recorded seven-day average maximum temperature of 71.9°F at RM 8 in 1994, a low flow year, could have caused physiological stress or death to incubating eggs or newly emerged alevins.

Juvenile salmonids are variable in their temperature requirements, though most species are at risk when temperatures exceed 23-25°C (Bjornn and Reiser 1991). Bell (1986) reported that preferred temperatures for juvenile steelhead range from 10-13°C (50-55.4°F). As noted above, instream temperatures in the lower reaches of the Chewuch exceed that range from July through September. Water temperatures in certain lower reaches of the Chewuch are probably higher than what was measured at RM 8 because of the additional diversions downstream from the measuring station.

2. Upper Columbia River Spring Chinook Salmon

Water diversion affects chinook habitat in the lower 7.5 miles of the Chewuch when natural flow conditions cannot maintain all chinook life stages (i.e., pre-spawning survival, egg-to-smolt survival, and upstream/downstream migration survival). Operation of the ditch during low flow periods (usually late July-October) increases water temperature in the lower 7.5 miles of the river. Water temperature data collected by WDFW in August and September 1994 at RM 8, indicated the monthly mean temperatures are at 61.8°F and 61.2°F, respectively. Those monthly average temperatures would coincide with the presence of spring chinook salmon attempting to spawn in the river. Water temperature that exceeds 60°F is considered to be above the upper tolerance for spawning chinook (Bell 1991). Water withdrawal can also lead to temporary thermal barriers to chinook migration. These barriers can delay spawning. Delayed spawning can decrease productivity. Operation of the Skyline Ditch exacerbates both low instream flow and elevated water temperature during the late summer/early fall seasons.

Water temperature greater than 60°F is not properly functioning for spring chinook salmon spawning. Water temperature in he lower eight miles of the Chewuch falls into this category.[7] In a recent low-water year (1994), the seven-day average maximum temperature was 71.9°F at RM 8 (USFS 1998). This temperature data was collected upstream of the Skyline Ditch (RM 7.5) and Fulton Canal (RM 0.9) diversions. Additional downstream diversions probably caused further water temperatures increases because of decreased instream flows.

Bell (1991) reported preferred temperature ranges of 5.0-14.4°C (41-58°F) for spawning chinook salmon, with 50 percent egg fatality occurring when the water temperature exceeded 60.8°F. By comparison with the 1994 WDFW monthly mean temperature data collected at RM 8, the average monthly water temperatures for August-September would exceed the 50 percent egg fatality temperature threshold when chinook would be spawning and when fertilized eggs are incubating in the gravel. The proposed diversion of 17 cfs by the Skyline Ditch at RM 7.5 would further contribute to elevated water temperatures above the preferred ranges to incubating chinook eggs within the action area because of a reduction in river flow, water depth, and velocity.

[7]The terms "not properly functioning" and "at risk" refer to determinations by the agency proposing the action and are described in NMFS 1996 document described in footnote (2).

Seymour (1956) carried out comprehensive studies on temperature effects on the development of chinook salmon from the egg to fingerling stage. Environmental temperature was correlated with the number of vertebrae, egg fatality, the number of abnormal fry, and the duration of the hatching period. For eggs reared at temperatures between 4.4 and 14.4°C (39.9-60.8°F), no differences were observed, but defects and fatality increased at both higher and lower temperatures. This would indicate that operating the Skyline Ditch during certain low summer baseflow conditions, the temperature conditions for egg incubation would be further degraded from the current not properly functioning environmental baseline and could result in increased egg fatality (NMFS 1996c).

Juvenile and resident salmonids are variable in their temperature requirements, though most species are at risk when temperatures exceed 23-25°C (73.4-77°F) (Bjornn and Reiser 1991). Bell (1991) reported that the upper lethal (50 percent fatality) temperature for juvenile chinook salmon is 26.2°C (79.1°F).

D. Summary of Effects

The upper Chewuch River watershed is functioning appropriately for the factors and habitat indicators that influence salmonid populations and production (USFS 1998). However, the lower watershed, including the action area, has been subject to continuing land management activities that have degraded riparian and instream habitats (USFS 1998). The proposed action would result in seasonal irrigation flow diversion from the Chewuch River that would degrade the instream peak/base flow habitat indicator. For steelhead, the importance of that reduction in instream flow and elevated water temperature would become magnified during the late summer/early fall when embryos in their redds would be hatching and alevins are emerging from the gravels, and for rearing juveniles. For spring chinook, the reduction in instream flow and elevated water temperature would become magnified for adults attempting to return to spawn, egg incubation, and for rearing juveniles. Seasonal reductions in river flow caused by the diversion would continue to reduce the quantity and quality of spawning, incubating, rearing, and migration habitat essential for salmonid egg-to-smolt survival. In contrast, local habitat conditions could be expected to dramatically improve if natural flows remained in the river.

NMFS believes that operation of the Skyline Ditch during seasonal low base flow periods would significantly reduce the amount of water available for instream flow for steelhead and spring chinook habitat protection and would cause a reduction in the amount or quality of habitat available for spawning, egg incubation, refugia from predators, refugia suitable for avoidance of elevated water temperatures, availability of food, increased competition for space and food sources, and impaired migration habitat. The same kinds of adverse effects are likely to occur to both the steelhead and chinook, although the specific levels of impacts to each species would vary by life stage and time of year.

VI. CUMULATIVE EFFECTS

Cumulative effects are defined as "those effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation" (50 C.F.R. § 402.02). Future Federal actions that are unrelated to the proposed action are not considered in this section they will be the subject of future interagency consultation.

Generally, local conservation efforts including the Omak Creek Watershed Plan (1995), will continue to improve conservation and restoration of steelhead and chinook salmon habitat on non-Federal land in the region of the proposed action. Furthermore, improvements such as infrastructure upgrades planned for other water diversions in the Methow Basin will probably reduce the contribution of those diversions to future habitat degradation.
Existing studies report that conversion of water use from irrigation to domestic use is related to real estate development in the Methow Basin (Peterson and Jackson, 1990, EMCON, 1993, and Methow Valley Planning Committee, 1994). Continuing real estate development (especially for residential use) is expected to continue into the foreseeable future. The precise effects of expected development on instream flows during low flow periods, late summer/early fall and winter, have not been documented. However, estimates from these reports show that if only 5 percent of the saved water from total irrigable acres in the basin (12,900 acres) is converted to domestic use, an additional 950 homes could be built in the basin, which could support approximately 2,800 people. The basin's current population is only 4,500. Using water saved from irrigation to support development in the face of an expanding population in the basin will maintain at risk and not properly functioning habitat indicators in the area of the proposed action.

One measure of potential cumulative impacts is the number and magnitude of applications for water rights within the action area on the Chewuch River. As of this date, there are 25 applications to WDOE for ground-water wells, totaling 6.7 cfs (3005.3 gpm), and one application to withdraw 0.0002 cfs (0.11 gpm) of surface water. The trend toward groundwater claims is expected to continue. Increasing demand on groundwater would contribute to maintaining at risk and not properly functioning habitat indicators in the area of the proposed action.

Other non-federal diversions in the Chewuch River contribute to cumulative adverse effect on instream flows for fish. For example, the two other sizable diversions are Chewuch Canal (30 cfs) and Fulton Canal (27 cfs) located above and below Skyline Ditch, respectively. Because these diversions do not constitute a federal action, no ESA consultation will be done and withdrawals are expected to continue at similar levels into the future. Accordingly, they will contribute to maintaining at risk and not properly functioning habitat indicators.

For purposes of this description of cumulative, NMFS assumes that future non-federal activities in the area of the proposed action will continue into the future at present or increased intensities. Accordingly, these actions will contribute to maintenance of at risk and not properly functioning habitat indicators.

VII. CONCLUSION

In this step of the analysis, NMFS determines whether the action is likely to jeopardize the listed species by determining if the species can be expected to survive with an adequate potential for recovery. NMFS' process for making jeopardy determinations for habitat-altering actions is explained in Attachment 3. In making this determination, NMFS must consider the estimated level of injury or death attributable to: (1) collective effects of the proposed or continuing action, (2) the environmental baseline, and (3) any indirect or cumulative effects. This evaluation must take into account measures for survival and recovery specific to the listed species' life stages that occur beyond the action area.

NMFS also evaluates whether the action, directly or indirectly, is likely to destroy or adversely modify the listed species' critical habitat. NMFS must determine whether habitat modifications appreciably diminish the value of critical habitat for both survival and recovery of listed species. NMFS identifies those effects of the action that impair the function of any essential habitat element of critical habitat. NMFS then considers whether such impairment appreciably diminishes the habitat's value for the species' survival and recovery. If NMFS concludes that the action will jeopardize the species or adversely modify or destroy critical habitat it must identify any reasonable and prudent alternatives available.

NMFS reviewed the current status of Upper Columbia River steelhead and spring chinook salmon, the environmental baseline for the action area, the direct, indirect, and cumulative effects of the proposed action. NMFS concludes that the proposed action will reduce the functioning of at risk habitat indicators in the action area. Furthermore, the proposed action will impair the ability of not properly functioning habitat indicators to improve toward properly functioning condition. Habitat in the Methow Basin is particularly important for the recovery of the Upper Columbia River Steelhead and spring chinook ESUs because more than 1,100 miles of historical fish habitat upstream of Chief Joseph Dam is not accessible. Steelhead and chinook salmon populations in the action area are depressed and continue to decline because of altered hydrology in natal and spawning streams and other factors. Habitat in the action area contains unique features and elements which if restored, would aid in recovery of the listed species. However, the action as proposed will result in continuing degradation of habitat features necessary for the survival and recovery of the species. Based on the foregoing, it is NMFS' biological opinion that the action, as proposed, is likely to jeopardize the continued existence of both steelhead and spring chinook salmon and result in the destruction or adverse modification of designated critical habitat for both steelhead and spring chinook salmon.

NMFS' jeopardy conclusion in this case is supported by several considerations, including the following:

- Diverting up to 17 cfs during late summer/early fall baseflow conditions would potentially result in dewatering redds and/or result in an appreciable reduction in salmonid egg-to-smolt survival through adverse habitat modification or destruction for both steelhead and spring chinook. This would prevent the attainment of Aquatic Conservation Strategy Objectives 2, 4, and 6.[8] The proposed action would hinder the maintenance and restoration of spatial and temporal connectivity of refugia, hinder the maintenance or restoration of water quality necessary to support healthy riparian and aquatic ecosystems, and hinder instream flows sufficient to create and sustain riparian and aquatic habitats and to retain patterns of nutrient and wood routing.

- Delay of spring chinook salmon returning to spawn would be likely to occur from thermal and low flow barriers. Thermal and low flow barriers would hinder the maintenance and restoration of spatial and temporal connectivity of refugia, and hinder the maintenance or restoration of water quality necessary to support healthy riparian and aquatic ecosystems.

- The cumulative effect of continued land use activities in the lower Chewuch River watershed that degrades riparian and aquatic habitats and will inhibit recovery of local populations. Off-Forest land management actions continue to prevent/hinder the maintenance and restoration of spatial and temporal connectivity of refugia, prevent/hinder the maintenance or restoration of water quality necessary to support healthy riparian and aquatic ecosystems, and hinder instream flows sufficient to create and sustain riparian and aquatic habitats and to retain patterns of nutrient and wood routing.

VIII. REASONABLE AND PRUDENT ALTERNATIVE

Section 402.02 of the ESA implementing regulations define “reasonable and prudent alternative (RPA) actions” as actions that (1) can be implemented in a manner consistent with the intended purpose of the action; (2) can be implemented consistent with the scope of the action agency’s legal authority; (3) are economically and technologically feasible; and (4) would avoid the likelihood of jeopardizing the continued existence of listed species and avert the destruction or adverse modification of designated critical habitat.

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[8]These objectives include the following: (2) Maintain and restore spatial and temporal connectivity within and between watersheds. Lateral, longitudinal, and drainage network connections include floodplains, wetlands, upslope areas, headwater tributaries, and intact refugia. These network connections must provide chemically and physically unobstructed routes to areas critical for fulfilling life history requirements of aquatic and riparian-dependant species; (4) maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain within the range that maintains the biological, physical, and chemical integrity of the system and benefits survival, growth, reproduction, and migration of individuals composing aquatic and riparian communities; and (6) maintain and restore in-stream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing. The timing, magnitude, duration, and spatial distribution of peak, high, and low flows must be protected.

The following RPA identifies conditions that the USFS can place on the special use permit for the operation of Skyline Ditch that allow the USFS to issue the special use permit while avoiding jeopardy to listed species and the destruction or adverse modification of critical habitat. The USFS is required to notify NMFS of its decision as to whether it will implement the RPA.

A. Elements of the RPA

1. Maintain ESA Flows

The most significant adverse effects of the proposed action result from low flow levels that meet the biological needs of neither Upper Columbia River steelhead nor spring chinook. Therefore, the most important measure to avoid jeopardizing the species is to increase the amount of water in the Chewuch River during low flow periods. If the Skyline Ditch operates without causing the level of water in the Chewuch River to fall below the levels necessary to meet the life history needs of listed steelhead and chinook salmon, its operations are not likely to jeopardize these species. Requiring Skyline Ditch Company to modify or curtail operations to maintain ESA-compliant flow levels is the first element of the RPA.

"ESA flow levels" for the Chewuch subbasin are the instream flows needed to provide properly functioning habitat for steelhead and spring chinook salmon in the subbasin. NMFS has established the following initial ESA flows for the Chewuch River:

Table 1: ESA Flows in cubic feet per second (cfs) for the Chewuch River, Measured at RM 0.2

April 1-15	255 cfs	August 1-15	271
April 16-30	398	August 16-31	185
May 1-15	425	September 1-15	138
May 16-31	425	September 16-30	121
June 1-15	425	October 1-15	142
June 16-30	425		
July 1-15	425		
July 16-31	425		

The USFS should condition the Skyline Ditch special use permit to require that ditch operations be modified or curtailed to maintain these flows. The condition should require diversions to cease or be delayed if these flows cannot be maintained.

2. Install and Maintain an Adequate Fish Screen

Adverse effects to listed species also result from impingement on the fish screen and stranding in the ditch if the screen is not adequate to keep fish out of the ditch. To remedy these problems, the special use permit should be conditioned to require the permittee to design, construct, and maintain a fish screen that is adequate to prevent impingement or injury to fish at the full range of potential diversion flows. The fish screen design, construction, and maintenance should be consistent with screen criteria developed by the National Marine Fisheries Service (NMFS 1995).

B. Rationale for ESA Flow Levels

There is no single best method for determining what flows are necessary to meet the biological requirements of listed fish, and the method chosen depends largely on available data (DeVries et al., 2000). The method described below is the one NMFS has chosen at this time for the Chewuch subbasin, based on the best available scientific information. It is likely that additional information in the future will trigger reevaluation of these ESA flow levels. Future information can also allow an alternate method of determining ESA flows. NMFS welcomes new information and discussion with knowledgeable individuals regarding determination of ESA flow levels.

At the outset, NMFS acknowledges that the ESA flow levels established in this biological opinion differ from those found in previous draft opinions. Previous flow numbers were based on measurements taken after diversions had withdrawn unknown amounts of water. Accordingly, these numbers were not reliable for approximating natural flow levels. In addition, since the 1999 draft of this opinion, subsequent analysis (DeVries, et al., 2000) has resulted in flow protocols that recommend the use of flow and habitat studies for determining ESA flows.

Based on analysis of available flow data and studies, and consistent with NMFS protocols (Bilby 2000; DeVries et al., 2000), NMFS used the following method for determining ESA flows for the Chewuch River: *ESA flows are the optimum flows from the IFIM study, at 50% exceedence, when these flows are available during an average year. At times of the year when these flows are not reached during an average year, an approximation of natural flows is used.*

The data and reasoning used in this analysis are described below.

1. Optimum Flows

The IFIM study (Caldwell and Catterson, 1992) currently provides the most comprehensive analysis for instream flow habitat needs for steelhead and spring chinook on the Chewuch River. The IFIM transect at RM 1.3 provides a representative sample of the channel characteristics in the lower Chewuch River. Data collected at RM 1.3 can be used to extrapolate flow requirements at the USGS gauge at RM 0.2 (Caldwell 2000).

The IFIM study depicts flow levels which maximize habitat conditions required for life histories of each fish species. Optimum flows are depicted on the habitat curves as the point on the curve that maximizes weighted useable area and flows for each species. When multiple species are being addressed, NMFS selected the highest flow to ensure all listed species' needs are met.

Table 2: Chewuch River Optimum Flows for Various Life Stages

r = rearing, s = spawning, i = incubation, p = passage

Spring Chinook	150 cfs (r), 275 cfs (s), 425 cfs (i), and 425 cfs (p)
Steelhead	400 cfs (r), 425 cfs (s), 425 cfs (i), and 425 cfs (p)

Optimum flows are the preferred flow regimes for each listed species, but in some years these flow levels cannot be achieved in nature. In circumstances where optimum flows were likely to occur under natural conditions, the ESA flows have been established at the IFIM optimum flow levels. However, when IFIM optimum flows were not likely to occur in nature, additional flow data was assessed to approximate natural flows and determine ESA flow levels per agency protocols (Bilby 2000; De Vries et al. 2000; and Reiser 2000).

2. Natural Flows

When the IFIM optimum flow could not be obtained naturally (without diversions) in an average water year, the ESA flow was established at the approximate natural flow. The natural hydrograph was developed by using a 50% exceedence curve from the Methow Water Budget report (Golder Associates Inc. 1993). Since all measurements in the IFIM were taken after diversions, diversion amounts were added to the 50% exceedence value to estimate the natural flow. These included the highest historical diversion amounts of the ditches and transmission lines, totaling 91.2 cfs. Return flow of 21 cfs was then subtracted from the amount to obtain a natural flow value for a particular period during an average year.

NMFS used the 50% exceedence hydrograph for determining a natural hydrograph because it represents the most accurate depiction of flow conditions during an average year and is commonly used for long-term planning purposes. The curve approximates flows that can be expected to be achieved and/or exceeded 50% of the time. The flow values from the curve represent mean daily flows during a two-week interval for the period of record for that station. The curve is derived from actual flow measurements. The method used to determine amounts to add to the 50% exceedence curve to derive natural flows is described below.

Control Points

The control points used by NMFS for the ESA flow analysis are as follows:

Table 3: Chewuch River Log

River Mile	Landmark
0.0	Confluence with the Methow River
0.2	USGS gauge
0.9	Fulton Canal diversion (27 cfs)
1.3	1992 IFIM transect (Note: possible gain of 21 cfs between 0.2 and 1.3)
6.8	Cub Creek
7.0	USFS boundary
7.5	Skyline Ditch diversion (17 cfs)
8.1	Chewack Canal diversion (30 cfs)
8.7	Former gauge for 1977 Ecology baseflows (gauge no longer at site)
11.5	Eight Mile Creek with Mason Ditch diversion (0.5 cfs), Eight Mile Ditch diversion (7.2 cfs) and water transmission lines (0.5 cfs)

Existing Water Uses

The surface diversions on the Chewuch River were estimated based on WDOE files from 1991[9] and USFS BAs (USFS, 1998 and 2000). NMFS used the diversion amount based on the highest historical use, rather than the amounts found in the water rights or claims, because many of the paper rights or claims are outdated and often collectively far exceed the stream or system capacity. In addition, NMFS used the highest historical uses prior to 1993 to ensure consistency of data in calculating a natural flow curve from the 50% exceedence data found in Caldwell and Catterson (1992) and Golder and Associates (1993). A summary of diversion amounts follows.

[9]NMFS did not use Ecology's 1977 base flows (WDOE 1976) for fish habitat analyses because they were not based upon measured flow data either at or below the diversions.

Table 4: Historic Surface Water Diversions on the Chewuch River

Section 7 Diversions (Special use permit)	Quantity (cfs)
Skyline Ditch	26.0
Eight Mile Ditch	7.2
Mason Ditch	0.5
Transmission Lines	0.5
Subtotal	34.2

Other Diversions	Quantity (cfs)
Fulton Canal	27.0
Chewack Canal	30.0
Subtotal	57.0

Total amount of diversions: 91.2 cfs

Groundwater Recharge/Return Flow

Return to the river of approximately 21 cfs has been documented between the IFIM transect at RM 1.3 and the USGS gauge at RM 0.2 (Caldwell and Catterson, 1992 and Caldwell, 2000).[10] The origin and timing of the recharge is not known. This 21 cfs is the only recharge that has been documented to date, so it is the only recharge figure NMFS used in this analysis. NMFS recognizes that this recharge estimate is based on a one-time measurement and anticipates that it will be refined with further studies by the USFS and the permittee.

Summary of Methodology

A summary of the data and ESA flows (column 4) is outlined in Table 5.

[10] In September 1994, the gauge at RM 0.2 registered a decrease of only 6 cfs from the IFIM transect at RM 1.3 when the Fulton canal at RM 0.9 was diverting up to 27 cfs. Thus it appears a gain of 21cfs entered the river system between RM 1.3 and 0.2.

Table 5: Derivation of ESA Flows in cfs for the Chewuch River, Measured at RM 0.2

Dates	50% Exceedence (1)	Natural Flows (2)	IFIM Optimum (3)	ESA Flows (4)
April 1-15	185	255.2	425	255
April 16-30	328	398.2	425	398
May 1-15	781	851.2	425	425
May 16-31	1229	1299.2	425	425
June 1-15	1111	1181.2	425	425
June 16-30	846	919.2	425	425
July 1-15	663	733.2	425	425
July 16-31	432	502.2	425	425
August 1-15	201	271.2	400	271
August 16-31	115	185.2	400	185
September 1-15	68	138.2	400	138
September 16-30	51	121.2	400	121
October 1-16	72	142.2	400	142

1. 50% exceedence values derived from Golder Associates Inc. (1993) and include diversions.
2. Natural flows = 50% exceedence value + diversions (91.2 cfs) - recharge (21 cfs).
3. IFIM optimum flows derived from 1992 IFIM study (Caldwell and Catterson 1992).
4. ESA flows = IFIM optimum flows when available during an average year (50% exceedence) or natural flows, whichever is less.

The NMFS recognizes that the data referenced above might not cover all the natural cycles of climate and water yield. However, this scientific information is currently the best available for determining flow conditions on the Chewuch River. Additional flow studies will be conducted on the Chewuch and the results will be considered in establishing future flow regimes.

C. Conclusion

This RPA is likely to avoid jeopardy to endangered Upper Columbia River steelhead and Upper Columbia River spring chinook salmon and to avoid destruction or adverse modification of designated critical habitat. It will eliminate impingement and stranding in the Skyline Ditch, and it will optimize, within the parameters of this consultation, the likelihood of sufficient instream flows in the action area to provide for the biological needs of the listed species. The NMFS recognizes that the Skyline Ditch is not the only diversion on the Chewuch River, and that because of other withdrawals, at times ESA flows might not be achieved even without any diversion by Skyline. The NMFS is not consulting with regard to these other diversions because they are entirely on non-federal land and consequently there is no federal action associated with their operation. The NMFS is investigating opportunities outside the section 7 framework for achieving ESA flows with the cooperation of the other diverters.

IX. INCIDENTAL TAKE STATEMENT

Sections 4 (d) and 9 of the ESA prohibit any taking (harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, collect, or attempt to engage in any such conduct) of listed species without a specific permit or exemption. Harm is further defined by NMFS to include significant habitat modification or degradation that results in death or injury to listed species by "significantly impairing behavioral patterns such as breeding, spawning, rearing, migrating, feeding, and sheltering." (50 C.F.R. § 222.102) Incidental take is take of listed animal species that results from, but is not the purpose of, the Federal agency or the applicant carrying out an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to, and not intended as part of, the agency action is not considered prohibited taking provided that such taking is in compliance with the terms and conditions of this incidental take statement.

The measures described below are non-discretionary; they must be implemented by the action agency so that they become binding conditions of any grant or permit issued to the applicant as appropriate, in order for the exemption in section 7(o)(2) to apply. The USFS has a continuing duty to regulate the activity covered in this incidental take statement. If the USFS 1) fails to retain the oversight to ensure compliance with these terms and conditions, the protective coverage of section 7(o)(2) can lapse.

An incidental take statement specifies the impact of any incidental taking of endangered or threatened species. It also provides reasonable and prudent measures that are necessary to minimize impacts and sets forth terms and conditions with which the action agency must comply in order to implement the reasonable and prudent measures.

A. Amount or Extent of the Take

NMFS has developed the following incidental take statement based on the premise that the reasonable and prudent alternative will be implemented.

NMFS anticipates that the action covered by this biological opinion has more than a negligible likelihood of resulting in incidental take of listed species through stream diversion that contributes to low instream flows and elevated water temperature. The proposed action would likely result in destruction or adverse modification of designated critical habitat of both steelhead and spring chinook salmon caused by late summer/early fall season water diversion. The RPA however, as described in the biological opinion and modified by the reasonable and prudent measures and terms and conditions, is expected to result in a substantial decline in the extent of take. Effects of the action such as these are largely unquantifiable, but are not expected to be measurable as long-term effects on the species' habitat or population levels. The best scientific and commercial data available are not sufficient to enable NMFS to estimate a specific amount of incidental take to the listed species themselves. In instances such as these, NMFS designates the expected level of take as "unquantifiable." Based on the information in the BAs, NMFS anticipates that an unquantifiable amount of incidental take could occur as a result of the action covered by this biological opinion.

B. Reasonable and Prudent Measures

NMFS believes that the following reasonable and prudent measure(s) are necessary and appropriate to avoid take of the listed species.

1. The USFS will require that the Skyline Ditch operate only with adequate and properly maintained structures, including the headgate and fish screen.

2. The USFS shall require the permittee to operate the Skyline Ditch to ensure compliance with ESA flow requirements as set forth in Table 4.

C. Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the ESA, the parties must comply with the following terms and conditions, which implement the reasonable and prudent measures described above. These terms and conditions are non-discretionary.

1. To implement reasonable and prudent measure 1:

   a. The USFS will inspect the headgate and fish screen at the completion of any structural modifications to ascertain whether required construction standards have been met. The USFS will require the permittee to inspect the headgate to ensure proper operation prior to commencing operations each irrigation season.

   b. The USFS will require the permittee to design, construct, and maintain a fish screen that is adequate to prevent stranding, impingement, and injury of fish at the full range of potential diversion flows. The fish screen design, construction, and maintenance must be consistent with screen criteria developed by National Marine Fisheries Service (NMFS 1995). The USFS will require that diversion flows not exceed the design criteria for the fish screen.

2. To implement reasonable and prudent measure 2:

   a. The USFS will require that the permittee modify its diversion operations to maintain instream flows as set forth in Table 4, column 4, as measured at RM 0.2. This means the permittee will cease or delay diversion if the ESA flow level for a particular period cannot be maintained.

   b. The USFS will require the permittee to notify the USFS when instream flows approach within 10 cfs of the instream flows identified in Table 4, column 4, as measured at RM 0.2. At that time, the USFS will ensure that the permittee begins incrementally ramping down the flows at the Skyline Ditch headgate to stimulate fish that might be rearing in the ditch upstream of the screens to migrate from the ditch via the bypass. This flow ramping down procedure will be implemented 5-7 days prior to ditch shut off. Ramp-down procedures will be consistent with those promulgated by WDFW in its guidance on Fish Bypass Operation and Procedure for Coordinating Fish Bypass and Diversion Headgate Operation.

   c. The USFS will require the permittee to install and maintain continuous flow monitoring devices located (1) at the upstream point of diversion within the Skyline Ditch, i.e., the Cipolleti weir or similar measuring device, and (2) in the Chewuch River immediately downstream of the Skyline Ditch diversion. The permittee will provide data from these devices to the USFS or its designee upon request.

X. CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs Federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of listed species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat. The following are discretionary suggested actions that the USFS can implement in furtherance of its responsibilities under section 7(a)(1) of the ESA.

1. The USFS should recommend that permittee line the ditch or install enclosed pipe to minimize conveyance loss.

2. The USFS should recommend that prior to operating the Skyline Ditch each season, the permittee inspect and repair lined ditch or enclosed pipeline.

3. The USFS should recommend that the permittee conduct an assessment of hydraulic continuity in the subbasin and return flows in the Chewuch River. The results of such a study should be

sent to the USFS and NMFS, Washington State Habitat Branch in Olympia, Washington.

XI. REINITIATION OF CONSULTATION

Consultation must be reinitiated if: the amount or extent of taking specified in the Incidental Take Statement is exceeded, or is expected to be exceeded; new information reveals effects of the action that can affect listed species in a way not previously considered; the action is modified in a way that causes an effect on listed species that was not previously considered; or, a new species is listed or critical habitat is designated that can be affected by the action (50 CFR § 402.16).

NMFS understands that the permittee is developing an operation plan to repair the existing headgate, screen, and water delivery system. Once completed, the plan will provide a detailed implementation scheme to increase the efficiency of the irrigation system and eliminate potential take of listed species. When completed, NMFS anticipates the USFS and the permittee will provide NMFS with the new operational plan and request reinitiation of this consultation if warranted.

NMFS has based its determination of ESA flow levels needed to avoid jeopardizing the listed species on the best available scientific information. New information on flow levels in the Methow Basin is being gathered, and NMFS encourages submission of additional scientific information to further define the variability of flows on the Chewuch river and other Methow River tributaries. When this information becomes available, NMFS anticipates the USFS and the special use permittees will provide the new data to NMFS and contact NMFS to schedule meetings to analyze the new data. Reinitiation of this consultation to revise the ESA flow levels will be initiated if warranted by the new information.

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Attachment 3.

The Habitat Approach

Implementation of Section 7 of the Endangered Species Act for
Actions Affecting the Habitat of Pacific Anadromous Salmonids

Prepared by the National Marine Fisheries Service
Northwest Region
Habitat Conservation and Protected Resources Divisions
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I. Purpose

This document describes the analytic process and principles that the National Marine Fisheries Service (NMFS) Northwest Region (NWR) applies when conducting ESA § 7 consultations on actions affecting freshwater salmon[11] habitat.

II. Background

Section 7 of the Endangered Species Act[12] (ESA) requires Federal agencies to ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of their critical habitat.[13] Federal agencies must consult with National Marine Fisheries Service (NMFS) regarding the effects of their actions on certain listed species.[14] NMFS evaluates the effects of proposed Federal actions on listed salmon by applying the standards of § 7(a)(2) of the ESA as interpreted through joint NMFS and U.S. Fish and Wildlife Service (FWS) regulations and policies.[15] When NMFS issues a biological opinion, it uses the best scientific and commercial data available to determine whether a proposed Federal action is likely to (1) jeopardize the continued existence of a listed species, or (2) destroy or adversely modify the designated critical habitat of a listed species.[16]

The Services' ESA implementing regulations define "jeopardize the continued existence of" to mean: "...to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species."[17] Section 7(a)(2)'s requirement that Federal

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[11] For purposes of brevity and clarity, this document will use the word "salmon" to mean all those anadromous salmonid fishes occurring in, and native to, Pacific Ocean drainages of the United States – including anadromous forms of cutthroat and steelhead trouts, and not including salmonids occurring in Atlantic Ocean and Great Lakes drainages.

[12] 16 USC §§ 1531 *et seq*.

[13] 16 USC § 1536(a)(2) (1988).

[14] A 1974 Memorandum of Understanding between NMFS and FWS establishes that NMFS retains ESA jurisdiction over fish species that spend a majority of their lives in the marine environment, including salmon. *See* Memorandum of Understanding Between the U.S. Fish and Wildlife Service, United States Department of Interior, and the National Oceanic and Atmospheric Administration, United States Department of Commerce, Regarding Jurisdictional Responsibilities and Listing Procedures under the Endangered Species Act of 1973 (1974).

[15] *See* U.S. Fish and Wildlife Service and National Marine Fisheries Service., *Endangered Species Consultation Handbook: Procedures for Conducting Consultation and Conference Activities Under Section 7 of the Endangered Species Act.* U.S. Government Printing Office, Washington, D.C. (1998).

[16] 16 USC § 1536(a)(2) (1988).

[17] 50 CFR § 402.02 (1999).

agencies avoid jeopardizing the continued existence of listed species is often referred to as the "jeopardy standard."[18] The ESA likewise requires that Federal agencies refrain from adversely modifying designated critical habitat.[19] The Services' ESA implementing regulations define the term "destruction or adverse modification" of critical habitat to mean:

> . . . a direct or indirect alteration that appreciably diminishes the value of critical habitat for both the survival and recovery of a listed species. Such alterations include, but are not limited to, alterations adversely modifying any of those physical or biological features that were the basis for determining the habitat to be critical.[20]

A species is listed as endangered if it is in danger of extinction throughout all or a significant portion of its range.[21] A species is listed as threatened if it is likely to become endangered within the foreseeable future.[22] Listing a species under the ESA therefore reflects a concern for a species' continued existence—the concern is immediate for endangered species and less immediate, but still real, for threatened species. The purpose of the ESA is to provide a means whereby the ecosystems upon which listed species depend can be conserved, such that the species no longer require the protections of the ESA and can be delisted.[23] This constitutes "recovery" under the ESA.[24] Recovery, then, represents a state in which there are no serious concerns for the survival of the species.[25]

Impeding a species' progress toward recovery exposes it to additional risk, and so reduces its likelihood of survival. Therefore, in order for an action to not "appreciably reduce" the likelihood of survival, it must not prevent or appreciably delay recovery. Salmon survival in the wild depends upon the proper functioning of certain ecosystem processes, including habitat formation and maintenance. Restoring functional habitats depends largely on allowing natural processes to increase their ecological function, while at the same time removing adverse impacts of current practices.[26] Along these lines, the courts have recognized that no bright line exists in the ESA regarding the concepts of survival and

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[18] *See* M.J. Bean and M.J. Rowland, *The Evolution of National Wildlife Law. Third Edition.*Praeger Publishers, Westport, Connecticut, pp. 240, 253 & 260 (1997).

[19] 16 USC § 15536(a)(2) (1988).

[20] 50 CFR § 402.02 (1999).

[21] 16 USC § 1532(6) (1988).

[22] 16 USC § 1532(20) (1988).

[23] *See, e.g.,* 16 USC § 1532(3) (1988) (defining the term "conserve"); 16 USC § 1531 (b) (1988) (stating the purpose of the ESA).

[24] *See, e.g.,* 16 USC § 1533(f)(1) (1988) (describing the purpose of recovery plans).

[25] NMFS, *Memorandum from R.S. Waples, NMFS, to the Record* (1997).

[26] Stouder et al., *Pacific Salmon and Their Ecosystems: Status and Future Options*, Chapman and Hall, New York, New York (1997).

recovery.[27] Likewise, available scientific information concerning habitat processes and salmon population viability indicates no practical differences exist between the degree of function essential for long-term survival and that necessary to achieve recovery.[28]

III. Organization of Endangered Species Act § 7 Analyses

In conducting analyses of habitat-altering actions under § 7 of the ESA, NMFS uses the following steps: (1) Consider the status and biological requirements of the affected species; (2) evaluate the relevance of the environmental baseline in the action area to the species' current status; (3) determine the effects of the proposed or continuing action on the species; (4) consider cumulative effects; (5) determine whether the proposed action, in light of the above factors, is likely to appreciably reduce the likelihood of species survival in the wild or adversely modify its critical habitat. If jeopardy or adverse modification is found, NMFS must identify reasonable and prudent alternatives to the action if they exist.

The analytical framework described above is consistent with the Services' joint ESA § 7 Consultation Handbook[29] and builds upon the Handbook framework to better reflect the scientific and practical realities of salmon conservation and management on the West Coast. Below we describe this analytical framework in detail.

A. Describe the Affected Species' Status and Define its Biological Requirements.

1. Identify the Affected Species and Describe its Status

The first step in conducting this analysis is to identify listed species, and when known, populations of listed species, that can be affected by the proposed action. Under the ESA, a taxonomic species can be defined as a "distinct population segment."[30] NMFS has established a policy that describes such "distinct population segments" as Evolutionarily Significant Units (ESUs).[31] An ESU is a population or group of populations that is substantially reproductively isolated from other conspecific populations and represents an important component in the evolutionary legacy of the species.[32] In implementing the ESA, NMFS has established ESUs as the listing unit for salmon under its jurisdiction. Therefore, for

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[27] *Idaho Department of Fish and Game v. NMFS,* 850 F.Supp. 886 (D. OR 1994) (discussing NMFS' biological opinion concerning the Federal Columbia River Hydropower System).

[28] *See* 51 Fed. Reg. 19,926 (1982). In the preamble to the § 7 consultation regulations, the Services recognized that in some cases, no distinction between survival and recovery my exist, stating "If survival is jeopardized, recovery is also jeopardized...it is difficult to draw clear-cut distinctions" [between survival and recovery].

[29] *See* FWS and NMFS, *supra* note 5.

[30] 16 USC § 1532(16) (1988).

[31] *See* 56 Fed. Reg. 58,618 (1991).

[32] R.S. Waples, *Definition of "Species" Under the Endangered Species Act: Application to Pacific Salmon,* National Marine Fisheries Service (1991).

purposes of jeopardy determinations, NMFS considers whether a proposed action will jeopardize the continued existence of the affected ESU or adversely modify its critical habitat.[33]

When affected species and populations have been identified, NMFS considers the relative status of the listed species, as well as the status of populations in the action area. This can include parameters of abundance, distribution, and trends in both. Various sources of information exist to define species and population status. The final rule listing the species or designating its critical habitat is a good example of this type of information. Species' status reviews and factors for decline reports can also provide relevant information for this section. When completed, recovery plans and associated reports will provide a basis for determining species status in the action area.

2. Define the Affected Species' Biological Requirements

The listed species' biological requirements can be described in a number of different ways. For example, they can be expressed in terms of population viability using such variables as a ratio of recruits to spawners, a survival rate for a given life stage (or set of life stages), a positive population trend, or a threshold population size. Biological requirements can also be described as the habitat conditions necessary to ensure the species' continued existence (*i.e.*, functional habitats) and these can be expressed in terms of physical, chemical, and biological parameters. The manner in which these requirements are described varies according to the nature of the action under consultation and its likely effects on the species.

However species' biological requirements are expressed—whether in terms of population variables or habitat components—it is important to remember that there is a strong causal link between the two: actions that affect habitat have the potential to affect population abundance, productivity, and diversity; these effects are particularly noticeable when populations are at low levels—as they are now in every listed ESU. The importance of this relationship is highlighted by the fact that freshwater habitat degradation is identified as a factor of decline in every salmon listing on the West Coast.[34]

Habitat-altering actions continue to affect salmon population viability, frequently in a negative manner.[35] However, it is often difficult to quantify the effects of a given habitat action in terms of its impact on biological requirements for individual salmon (whether in the action area or outside of it). Thus it follows that while it is often possible to draw an accurate picture of a species' rangewide status—and in

[33] NMFS has recognized that in many cases ESUs contain a significant amount of genetic and life history diversity. Such diversity is represented by independent salmon populations that can inhabit river basins or major sub-basins within ESUs. In light of the importance of protecting the biological diversity represented by these populations, NMFS considers the effects of proposed actions on identifiable, independent salmon populations in judging whether a proposed action is likely to jeopardize the ESU as a whole.

[34] *See, e.g.*, 57 Fed. Reg. 14,653 (April 22, 1992) (Snake River spring/summer and fall chinook); 62 Fed. Reg. 24,588 (May 6, 1997) (Southern Oregon/Northern California coho); 63 Fed. Reg. 13,347 (March 18, 1998) (Lower Columbia River and Central Valley steelhead).

[35] *See* NMFS, *Making Endangered Species Act Determinations of Effect for Individual or Grouped Actions at the Watershed Scale* (MPI) (1996).

fact doing so is a critical consideration in any jeopardy analysis—it is difficult to determine how that status can be affected by a given habitat-altering action. Given the current state of the science, usually the best that can be done is to determine the effects an action has on a given habitat component and, since there is a direct relationship between habitat condition and population viability, extrapolate to the impacts on the species as a whole. Thus, by examining the effects a given action has on the habitat portion of a species' biological requirements, NMFS has a gauge of how that action will affect the population variables that constitute the rest of a species' biological requirements and, ultimately, how the action will affect the species' current and future health.

Ideally, reliable scientific information on a species' biological requirements would exist at both the population and the ESU levels, and effects on habitat should be readily quantifiable in terms of population impacts. In the absence of such information, NMFS' analyses must rely on generally applicable scientific research that one can reasonably extrapolate to the action area and to the population(s) in question. Therefore, for actions that affect freshwater habitat, NMFS usually defines the biological requirements in terms of a concept called properly functioning condition (PFC). Properly functioning condition is the sustained presence of natural[36] habitat-forming processes in a watershed (*e.g.*, riparian community succession, bedload transport, precipitation runoff pattern, channel migration) that are necessary for the long-term survival of the species through the full range of environmental variation. PFC, then, constitutes the habitat component of a species' biological requirements. The indicators of PFC vary between different landscapes based on unique physiographic and geologic features. For example, aquatic habitats on timberlands in glacial mountain valleys are controlled by natural processes operating at different scales and rates than are habitats on low-elevation coastal rivers.

In the PFC framework, baseline environmental conditions are described as "properly functioning," "at risk," or "not properly functioning." If a proposed action would be likely to impair[37] properly functioning habitat, appreciably reduce the functioning of already impaired habitat, or retard the long-term progress of impaired habitat toward PFC, it will usually be found likely to jeopardize the continued existence of the species or adversely modify its critical habitat or both, depending upon the specific considerations of the analysis. Such considerations can include for example, the species' status, the

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[36] The word "natural" in this definition is not intended to imply "pristine," nor does the best available science lead us to believe that only pristine wilderness will support salmon. The best available science does lead us to believe that the level of habitat function necessary for the long-term survival of salmon (PFC) is most reliably and efficiently recovered and maintained by simply eliminating anthropogenic impairments, and does not usually require artificial restoration. *See* Rhodes et. al., *A Coarse Screening Process for Potential Application in ESA Consultations.* Columbia River Inter-Tribal Fish Commission, Portland, Oregon, pp. 59-61, (1994); National Research Council, *Upstream: Salmon and Society in the Pacific Northwest. National Research Council*, National Academy Press, Washington, D.C., p. 201 (1996).

[37] In this document, to "impair" habitat means to reduce habitat condition to the extent that it does not fully support long-term salmon survival and therefore "impaired habitat" is that which does not perform that full support function. Note that "impair" and "impaired" are not intended to signify any and all reduction in habitat condition.

condition of the environmental baseline, the particular reasons for listing the species, any new threats that have arisen since listing, and the quality of the available information.

Since lotic[38] habitats are inherently dynamic, PFC is defined by the persistence of natural processes that maintain habitat productivity at a level sufficient to ensure long-term survival. Although the indicators used to assess functioning condition can entail instantaneous measurements, they are chosen, using the best available science, to detect the health of underlying processes, not static characteristics. "Best available science" advances through time; this advance allows PFC indicators to be refined, new threats to be assessed, and species status and trends to be better understood. The PFC concept includes a recognition that natural patterns of habitat disturbance will continue to occur. For example, floods, landslides, wind damage, and wildfires will result in spatial and temporal variability in habitat characteristics, as will anthropogenic perturbations.

B. Evaluate the Relevance of the Environmental Baseline in the Action Area to the Species' Current Status.

The environmental baseline represents the current basal set of conditions to which the effects of the proposed or continuing action would be added. It "includes the past and present impacts of all Federal, State, or private activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early § 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in process."[39]

The environmental baseline does not include any future discretionary Federal activities (that have not yet undergone ESA consultation) in the action area. The species' current status is described in relation to the risks presented by the continuing effects of all previous actions and resource commitments that are not subject to further exercise of Federal discretion. For a new project, the environmental baseline consists of the conditions in the action area that exist before the proposed action begins. For an ongoing Federal action, those effects of the action resulting from past unalterable resource commitments are included in the baseline, and those effects that would be caused by the continuance of the proposed action are then analyzed for determination of effects.

The reason for determining the species' status under the environmental baseline (without the effects of the proposed or continuing action) is to better understand the relative significance of the effects of the action upon the species' likelihood of survival and chances for recovery. Thus if the species' status is poor and the baseline is degraded at the time of consultation, it is more likely that any additional adverse effects caused by the proposed or continuing action will be significant.

The implementing regulations specify that the environmental baseline of the area potentially affected by the proposed action should be used in making the jeopardy determination. Consequently, delineating the

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[38] Running water.

[39] *See* 50 CFR § 402.02 (1999) (definition of "effects of the action"). Action area is defined by the consultation regulations (50 CFR 402.02) as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action."

action area for the proposed or continuing action is one of the first steps in identifying the environmental baseline. For the lotic environs typical of salmon habitat-related consultations, a watershed or sub-basin geographic unit (and its downstream environs) is usually a logical action area designation. Most habitat effects are carried downstream readily, and many travel upstream as well (*e.g.*, channel downcutting). Moreover, watershed divides provide clear boundaries for analyzing the cumulative effects of multiple independent actions.[40]

C. Determine the Effects of the Action on the Species.

In this step of the analysis, NMFS examines the likely effects of the proposed action on the species and its habitat within the context of the its current status and existing environmental baseline. The analysis also includes an analysis of both direct and indirect effects of the action. “Indirect effects” are those that are caused by the action and are later in time but are still reasonably certain to occur. They include effects on species or critical habitat of future activities that are induced by the action subject to consultation and that occur after the action is completed. The analysis also takes into account direct and indirect effects of actions that are interrelated or interdependent with the proposed action. “Interrelated actions” are those that are part of a larger action and depend on the larger action for their justification. “Interdependent actions” are those that have no independent utility apart from the action under consideration.

NMFS can use either or both of two independent techniques in assessing the impact of a proposed action. First, NMFS can consider the impact in terms of how many listed salmon will be killed or injured during a particular life stage and gauge the effects of that take’s effects on population size and viability. Alternatively, NMFS can consider the impact on the species’ freshwater habitat requirements, such as water temperature, substrate composition, dissolved gas levels, structural elements, etc. This second technique is especially useful for habitat-related analyses because, while many cause and effect relationships between habitat quality and population viability are well known,[41] they do not lend themselves to meaningful quantification in terms of fish numbers. Consequently, while this second technique does not directly assess the effects of actions on population condition, it indirectly considers this issue by evaluating existing habitat conditions in light of habitat conditions known to be conducive to salmon conservation.

Though there is more than one valid analytical framework for determining effects, NMFS usually uses a matrix of pathways and indicators to determine whether proposed actions would further damage impaired habitat or retard the progress of impaired habitat toward properly functioning condition. For the purpose of guiding Federal action agencies in making effects determinations, NMFS has developed and distributed a document detailing this method.[42] This document is discussed in more detail below. The

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[40] National Research Council, *Upstream: Salmon and Society in the Pacific Northwest. National Research Council*, National Academy Press, Washington, D.C., pp. 34, 213 & 359 (1996).

[41] *See* Spence et al., *An Ecosystem Approach to Salmonid Conservation*, ManTech Environmental Research Services Corporation, Corvallis, Oregon (1996).

[42] *See* NMFS, *Making Endangered Species Act Determinations of Effect for Individual or Grouped Actions at the Watershed Scale* (MPI) (1996).

levels of effects, or effects determinations, are defined[43] as:

> **"No effect."** Literally no effect whatsoever. No probability of any effect. The action is determined to have "no effect" if there are no proposed or listed salmon and no proposed or designated critical habitat in the action area or downstream from it. This effects determination is the responsibility of the action agency to make and does not require NMFS review.
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> **"May affect, not likely to adversely affect."** Insignificant, discountable, or beneficial effects. The effect level is determined to be "may affect, not likely to adversely affect" if the proposed action does not have the potential to hinder attainment of relevant properly functioning indicators and has a negligible (extremely low) probability of taking proposed or listed salmon or resulting in the destruction or adverse modification of their habitat. An insignificant effect relates to the size of the impact and should never reach the scale where take occurs.[44] A "discountable effect" is defined as being so extremely unlikely to occur that a reasonable person cannot detect, measure, or evaluate it. This level of effect requires informal consultation, which consists of NMFS concurrence with the action agency's determination.
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> **"May affect, likely to adversely affect."** Some portion or aspect of the action has a greater than insignificant probability of having a detrimental effect upon individual organisms or habitat. Such detrimental effect may be direct or indirect, short- or long-term. The action is "likely to adversely affect" if it has the potential to hinder attainment of relevant properly functioning indicators, or if there is more than a negligible probability of taking proposed or listed salmon or resulting in the destruction or adverse modification of their habitat. This determination would apply when the overall effect of an action has short-term adverse effects even if the overall long-term effect is beneficial. In such instances, NMFS conducts a jeopardy analysis.

The above effects determinations are applicable to individual fish, including fry and embryos. The MPI should be applied at spatial scales appropriate to the proposed action so that its habitat effects on individuals are fully taken into account. For example, if any of the indicators in the MPI are thought to be degraded by the proposed action to the extent that take of an individual fish results, the action is determined to be "may affect, likely to adversely affect." For actions that are likely to adversely affect, NMFS must conduct a jeopardy analysis and render a biological opinion resulting in one of the conclusions below:

> **"Not likely to jeopardize" and/or "Not likely to result in the destruction or adverse**

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[43] These definitions are adapted from those found in NMFS, *Making Endangered Species Act Determinations of Effect for Individual or Grouped Actions at the Watershed Scale* (MPI) (1996), and; U.S. Fish and Wildlife Service and National Marine Fisheries Service., *Endangered Species Consultation Handbook: Procedures for Conducting Consultation and Conference Activities Under Section 7 of the Endangered Species Act.* U.S. Government Printing Office, Washington, D.C. (1998)

[44] "Take" means to "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in such conduct." 16 USC §1532(19) (1988).

modification of critical habitat." The action does not appreciably reduce the likelihood of species survival and recovery or result in the destruction or adverse modification of its critical habitat.

"Likely to jeopardize" and/or "Likely to result in the destruction or adverse modification of critical habitat." The action appreciably reduces the likelihood of species survival and recovery or results in the destruction or adverse modification of its critical habitat.

D. Consider Cumulative Effects in the Action Area.

The ESA implementing regulations define "cumulative effects" as those effects caused by future projects and activities unrelated to the action under consideration (not including discretionary Federal actions) that are reasonably certain to occur within the action area.[45] Since all future discretionary Federal actions will at some point be subject to § 7 consultation, their effects will be considered at that time and are not included in cumulative effects analysis.

E. Jeopardy Determinations.

In this step of the analysis, NMFS determines whether (a) the species can be expected to survive, with an adequate potential for recovery, under the effects of the proposed or continuing action, the environmental baseline and any cumulative effects; and (b) whether the action will appreciably diminish the value of critical habitat for both the survival and recovery of the species. In completing this step of the analysis, NMFS determines whether the action under consultation, together with all cumulative effects when added to the environmental baseline, is likely to jeopardize the continued existence of the listed species or result in destruction or adverse modification of critical habitat.

For the jeopardy determination, NMFS uses the consultation regulations and the MPI analysis method to determine whether actions would further degrade the environmental baseline or hinder attainment of PFC at a spatial scale relevant to the listed ESU. That is, because salmon ESUs typically consist of groups of populations that inhabit geographic areas ranging in size from less than ten to several thousand square miles (depending on the species), the analysis must applied at a spatial resolution wherein the actual effects of the action upon the species can be determined.

The analysis takes into account the species' status because determining the impact upon a species' status is the essence of the jeopardy determination. Depending upon the specific considerations of the analysis, actions that are found likely to impair currently properly functioning habitat, appreciably reduce the functioning of already impaired habitat, or retard the long-term progress of impaired habitat towards PFC at the population or ESU scale will generally be determined likely to jeopardize the continued existence of listed salmon, adversely modify their critical habitat, or both. Specific considerations include whether habitat condition was an important factor for decline in the listing decision, changes in population or habitat conditions since listing, and any new information that has become available.

If NMFS anticipates take of listed salmon incidental to the proposed action, the biological opinion is accompanied by an incidental take statement with reasonable and prudent measures to minimize the

[45] 50 CFR § 402.02 (1999).

impact of such take, and non-discretionary terms and conditions for implementing those measures. Discretionary conservation recommendations may also accompany the biological opinion to assist action agencies further the purposes of habitat and species conservation specified in §§ 7(a)(1) and 7(a)(2).

F. Identify reasonable and prudent alternatives to a proposed or continuing action that is likely to jeopardize the continued existence of the listed species.

If the proposed or continuing action is likely to jeopardize the listed species or destroy or adversely modify critical habitat, NMFS must identify reasonable and prudent alternatives that comply with the requires of § 7(a)(2) and with the applicable regulations. The reasonable and prudent alternative must be consistent with the intended purpose of the action, consistent with the action agency's legal authority and jurisdiction, and technologically and economically feasible. At this stage of the consultation, NMFS will also indicate if it is unable to develop a reasonable and prudent alternative.

IV. Application Tools Useful in Conducting § 7 Analyses - The Matrix

As previously mentioned, NMFS has developed an analytic methodology to help determine the environmental effects a given action will have by describing an action's effects on PFC.[46] This document includes a *Matrix of Pathways and Indicators* (MPI; often called "The Matrix,") and a dichotomous key for making effects determinations based on the condition of the environmental baseline and the likely effects of a given project. The MPI helps the action agency and NMFS describe current freshwater habitat conditions, determine the factors limiting salmon production, and identify sensitive areas and any risks to PFC. This document only *helps* make effects determination, it does not describe jeopardy criteria per se.

The pathways for determining the effects of an action are represented as six conceptual groupings (*e.g.*, water quality, channel condition, and dynamics) of 18 habitat condition indicators (*e.g.*, temperature, width/depth ratio). Default indicator criteria[47] (mostly numeric, though some are narrative) are laid out for three levels of environmental baseline condition: properly functioning, at risk, and not properly functioning. The effects of the action upon each indicator is classified by whether it will restore, maintain, or degrade the indicator.

The MPI provides a consistent, but geographically adaptable, framework for effects determinations. The pathways and indicators, as well as the ranges of their associated criteria, are amenable to alteration through the process of watershed analysis. The MPI, and variations on it, are widely used in § 7 consultations. The MPI is also used in other venues to determine baseline conditions, identify properly functioning condition, and estimate the effects of individual management prescriptions. This assessment tool was developed for forestry activities. NMFS is working to adapt it for other types of land

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[46] NMFS, *Making Endangered Species Act Determinations of Effect for Individual or Grouped Actions at the Watershed Scale* (MPI) (1996).

[47] The unmodified "matrix" uses ranges of values for indicators that are generally applicable between species and across the geographic distribution of salmon. The indicators can be, and have been, modified for more specific geographic and species applications.

management, and for larger spatial and temporal scales.

For practical purposes, the MPI analysis must sometimes be applied to geographic areas smaller than a watershed or basin due to a proposed action's scope or geographic distribution. These circumstances necessarily reduce analytic accuracy because the processes essential to aquatic habitats extend continuously upslope and downslope, and may operate quite independently between drainages.[48] Such loss of analytic accuracy should typically be offset by more conservative management practices in order to achieve parity of risk with the watershed approach. Conversely, a watershed approach to habitat conservation provides greater analytic certainty, and hence more flexibility in management practices.

V. Conclusion

NMFS has followed regulations under §§ 7 and 10 of the ESA to develop an analytical procedure used to consistently assess whether any proposed action would jeopardize or conserve federally protected species. There is a legacy of a more than a century of profound human alterations to the Pacific coast drainages inhabited by salmon.[49] The analytical tool described as the MPI enables proposed actions to be assessed in light of the species current status, the current conditions, and expected effects of the action. Proposed actions that fail to conserve fish and their habitats as initially proposed can be redesigned to avoid jeopardy and begin to restore watershed processes. Conservation of listed salmon will depend largely on the recovery of watershed processes that furnish their aquatic habitat.

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[48] L. B. Leopold, *A View of the River*, Harvard University Press, Cambridge, Massachusetts, chapter 1 (1994).

[49] *See* Cone and Ridlington, *The Northwest Salmon Crisis, a Documentary History*. Oregon State University Press, Corvallis, Oregon, pp. 12-21 & 154-160 (1996); W. Nehlsen *et al., Pacific Salmon at the Crossroads: Stocks at Risk from California, Oregon, Idaho, and Washington*, Fisheries, Vol.16(2), pp. 4-21 (1991).